# MACHINERY

## *Design—Construction—Operation*

Volume 46 JANUARY, 1940 Number 5

**Tubing can now be made to any contour that can be turned on solid stock in a lathe by the use of a remarkable process, to be described for the first time in February MACHINERY. Steel tubing shaped by this process becomes much stronger and harder than it is in its original state. The process enables many kinds of tubular parts to be produced that were previously impractical on a commercial basis. Recent developments in broaching and the manufacture of big guns for the Army are among the many other subjects dealt with.**

### PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 206

Around the World with American Machine Tools *By Charles O. Herb* 109
American Machines in England's Busy Shops 120
Modernized French Factories Use American Machine Tools 126
Selling Machine Tools in South America *By H. K. Smyth* 132
Overseas Everywhere with General Motors 134
Russian Methods Developed Around American Machines 138
Progressive Methods in Japanese Shops 144
Editorial Comment 150
Machine Shop Training Once More a Pressing Problem—Industry Pays $576 to the Government for Each Worker Employed
James Emmett Gleason Awarded the A.S.M.E. Medal 153
Manufacturing Small-Arms Ammunition and Instruments at Frankford Arsenal *By Colonel Edwin D. Bricker* 154
Changing from Welded to Cast Frame Construction in Press Design *By E. V. Crane* 159
Careful Analysis of Proposed Products Simplifies Interchangeable Manufacture *By C. B. Gardiner* 162
Welded Tubular Frame Solves Heavy Machine Construction Problem *By E. Walters* 170
Drawing Isometric Circles *By J. S. Beggs* 172

### DEPARTMENTS

Engineering News Flashes 149
Ingenious Mechanical Movements 151
Design of Tools and Fixtures 165
Ideas for the Shop and Drafting-Room 169
Materials of Industry 174
New Trade Literature 177
Shop Equipment News 181

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York

ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER—*Vice-pres. and Treasurer*
ERIK OBERG .....*Editor*
FRANKLIN D. JONES.....*Associate Editor*
CHARLES O. HERB.....*Associate Editor*
FREEMAN C. DUSTON....*Associate Editor*

LONDON: MACHINERY, 83-113 Euston Road

PARIS: La Machine Moderne, 15 Rue Bleue

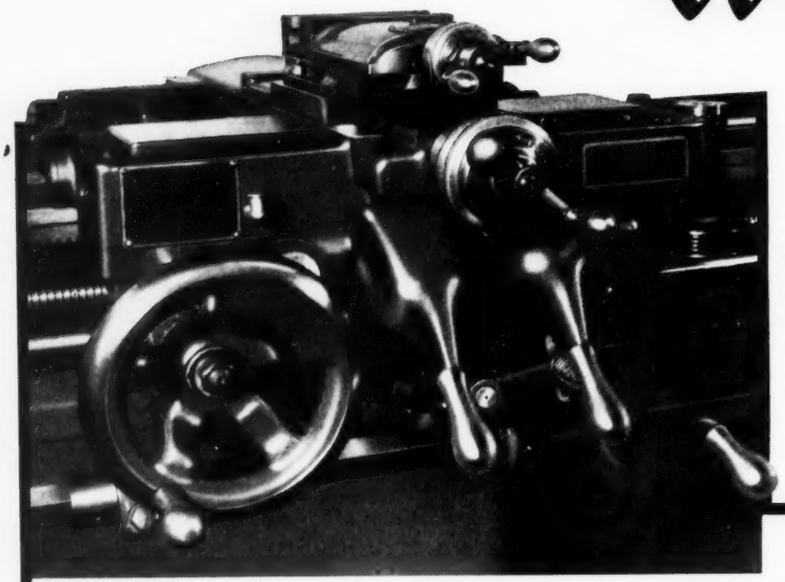
YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents, except this special number, which is $1. Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue. Send old as well as new address.

Copyright 1940 by The Industrial Press.
Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Member of A.B.P. Member of A.B.C.

Product Index 279-302
Advertisers Index 305-306

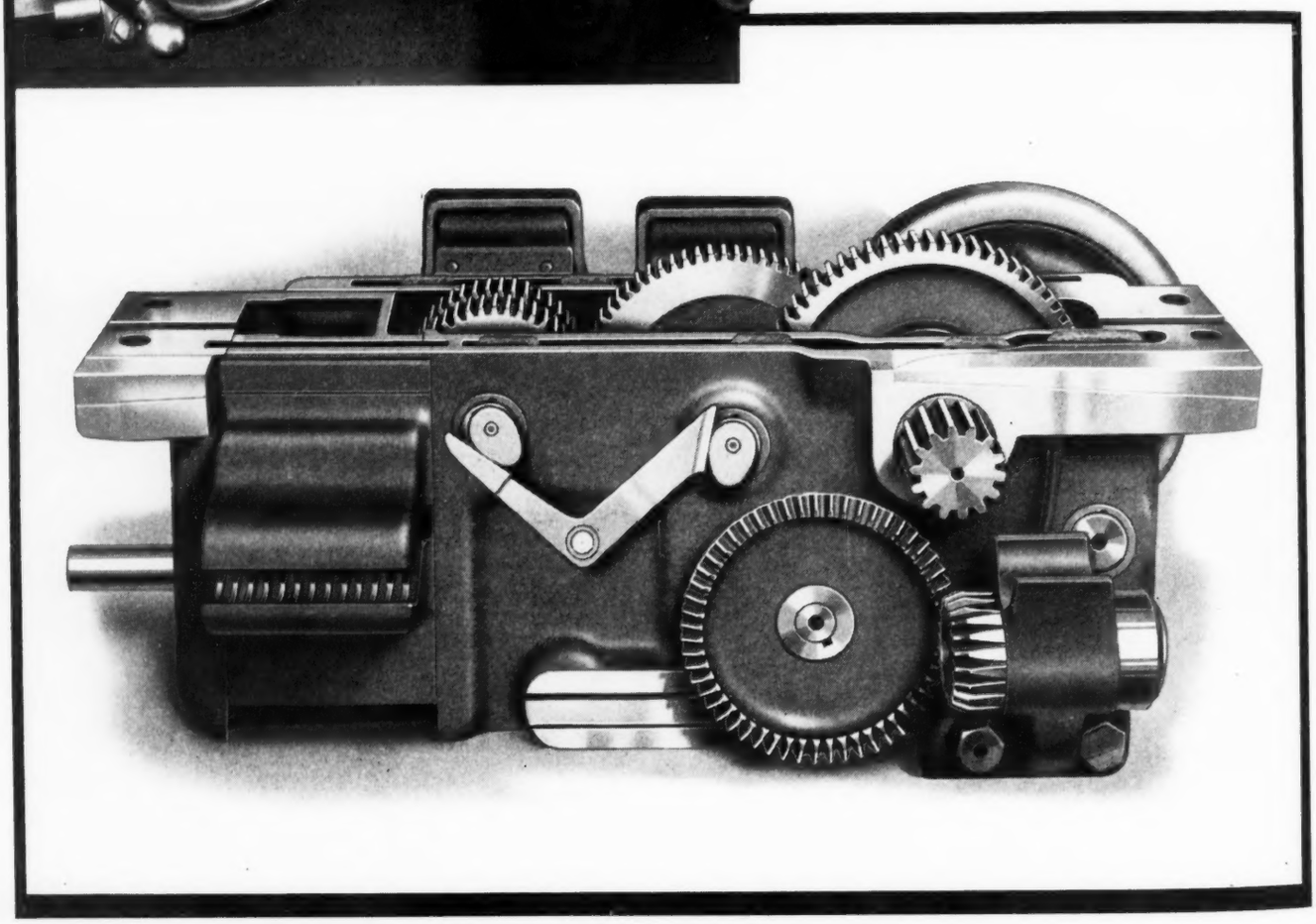
TOTAL DISTRIBUTION, 18,525

# *What* MAKES



THE APRON and CARRIAGE

REAR OF APRON



# LODGE & SHIPLEY

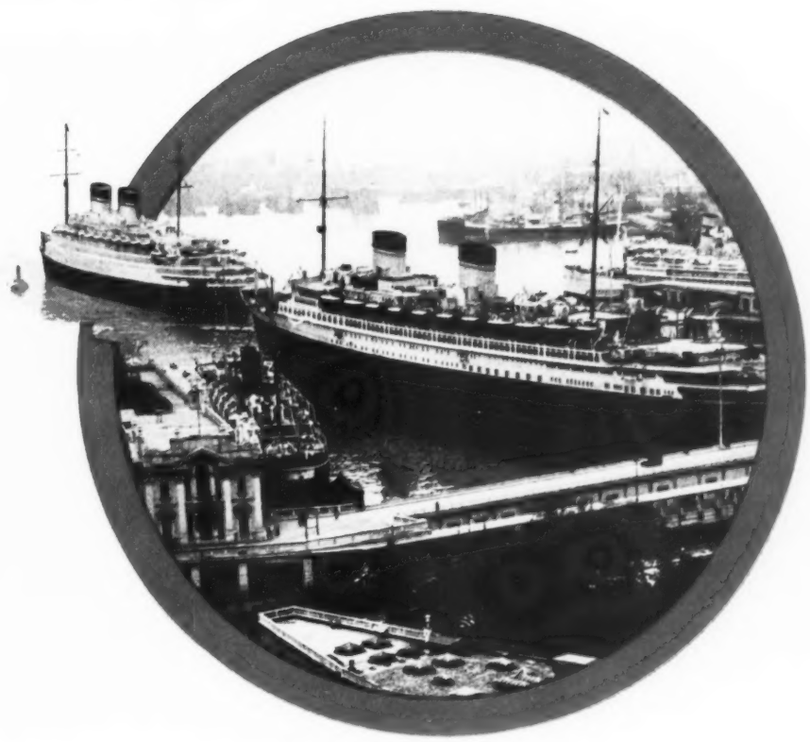
## MACHINE TOOL CO.

CINCINNATI OHIO

MACHINERY

Volume 46 NEW YORK, JANUARY, 1940 Number 5

# Around the World with American Machine Tools



*By CHARLES O. HERB*

THE demands from foreign countries for American-built machine tools and other metal-working machinery during the last two years have been without parallel in the history of the industry. During 1938, exports of American-built metal-working machinery had a total value of over $100,000,000, and it is estimated that $115,000,000 worth of machinery of this classification left our shores during the year just ended. It is interesting to note, in this connection, that the value of metal-working machinery sent abroad in 1917—the most important year prior to 1938 for exports of metal-working machines—was only $84,000,000.

This unprecedented demand for American metal-working equipment has, of course, been due largely to the needs of nations preparing for and prosecuting war, but an appreciable percentage of the equip-

# Around the World with

ment exported was for use in the production of agricultural machinery, automobiles, road-building equipment, electrical apparatus, and so on. In times like these it is well to remember that machine tools produce not only guns, explosive shells, airplanes, and other implements for the destruction of humanity but also products that contribute to the well-being of nations and individuals.

People all over the world look with envy on the high standards of living enjoyed in the United States. Small wonder then that wherever so-called backward nations seek to improve their social conditions, they strive to emulate the progressive manufacturing methods which, more than anything else, have brought what other peoples consider luxuries to practically all the citizens of our country.

The war in Europe has given American manufacturers of machine tools and other metal-working equipment an opportunity of winning permanent markets in countries that are in the early stages of industrialization. This is, of course, due to the fact that the greatest competitor abroad of our machine tool industry—Germany—is not now in a position to supply the needs of neutral countries, especially those of Latin America and the Orient. Any metal-working machines required by foreign countries in the furtherance of peacetime pursuits must necessarily be bought from our manufacturers at the present time. If these markets are cultivated to their utmost, American-built machines will have the opportunity to demonstrate convincingly their productive capacity, accuracy, and dependability. In other words, American-built machines now have the opportunity of so thoroughly proving their outstanding advantages that they will remain in demand when conditions in Europe become normal again.

As regards world markets for American-built metal-working machinery, it is interesting to note that during the year 1938 Germany exported equipment of that classification to a total value of $69,636,000. Of this amount, $6,580,000 worth went to Great Britain and $3,433,000 worth to France, two markets which are now practically entirely ours; in addition, $22,000,000 worth was sold to countries outside of Europe. Here is where the most favorable opportunities lie for the development of permanent markets for American metal-working machinery.

Latin America purchased, in 1938, German metal-working machinery to the extent of $4,182,000, whereas American builders exported only $2,310,353 worth of that class of machinery to the same countries. An opportunity, therefore, exists of at least tripling the export of metal-working machinery to Central and South American countries. It is not only of this amount of export business that far-sighted American machine tool builders should think, however, but rather of the potential markets in the event that Latin America becomes truly "industry-minded."

Generally speaking, nations all over the world, with the exception of those politically tied to Germany, have preferred American-built metal-working machines, because of their excellent repu-

*Photographs on this and preceding page are views of Genoa, Italy, obtained through the courtesy of the Italian Line.*

# American Machine Tools

tation and the fact that our progressive manufacturing methods have been developed around them. Foreign buyers, however, have not always been able to follow their preferences during recent years, because of the fact that foreign machine-building competitors were in a position to offer them lower prices; in the case of German machinery builders this was due to the direct export subsidy given by the German Government. If American manufacturers can prove outstanding superiority for their products during the present period, it is likely that machine tools and other metal-working equipment will be bought more on merit than on price alone when the war is a thing of the past.

With a view to fostering permanent foreign markets for machine tools and other metal-working machinery at a time that seems especially opportune, MACHINERY, is presenting in this and succeeding articles, a large number of illustrations showing American-built machine tools in actual operation in machine shops beyond the borders of the United States. The operations illustrated will show shop executives the world over how others confronted with manufacturing problems similar to their own have attained successful solutions through the application of American-built machinery.

An unusual machining operation in an Italian plant is the finish-boring of airplane engine propeller shafts, as illustrated in Fig. 1. The propeller shaft comes to the Gisholt fixed-center turret lathe rough-turned and with a hole drilled the full length. The shaft is chucked on the outside at one end, and is supported in a hinged type of steadyrest at the outer end.

Tools on the square toolpost on the carriage face and chamfer the outer end of the propeller shaft and rough-bore it to two diameters, while six piloted boring-bars on the turret rough- and finish-bore the work to four diameters, and form three tapers and two radii. Two additional tools on the turret ream straight and tapered surfaces. All of the boring-bars and the reamers are drilled to provide for the delivery of coolant to the cutting edges of the tools.

This machine is equipped with a three-jaw scroll chuck and has a bed extension of 24 inches. Feeds from 0.009 to 0.015 inch are employed in machining this steel forging, while the cutting speeds

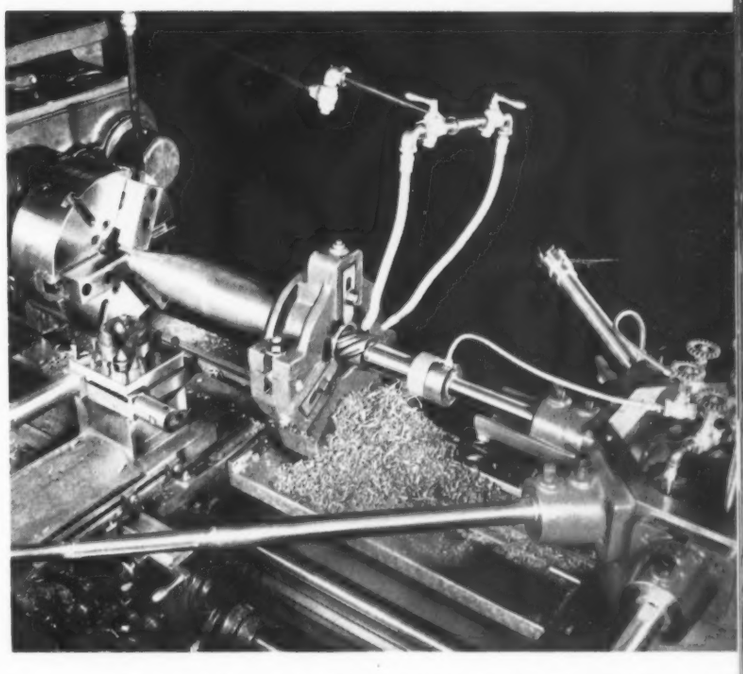
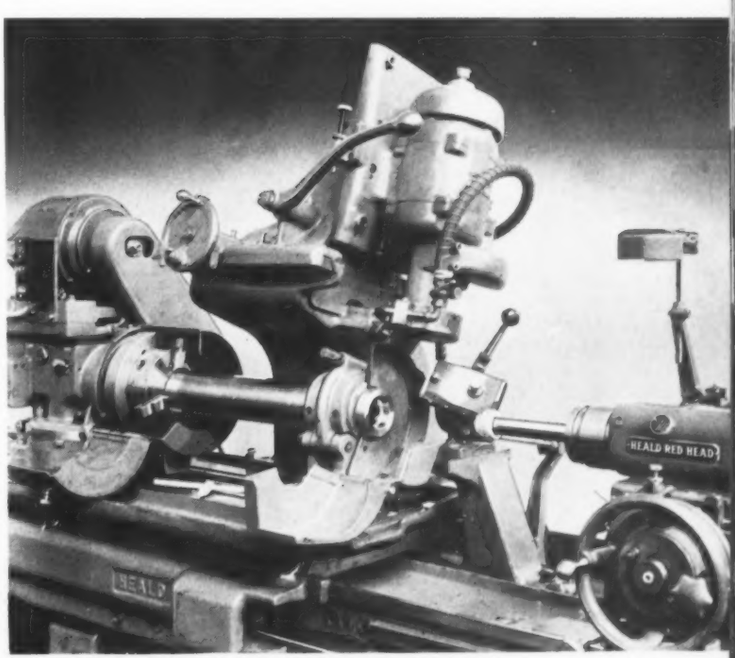


*Fig. 1. (Above) Finishing Steel Forged Propeller Shafts in an Italian Airplane Factory*

*Fig. 2. (Below) Grinding Various Surfaces on Lathe and Milling Machine Spindles in a Bohemian Shop*



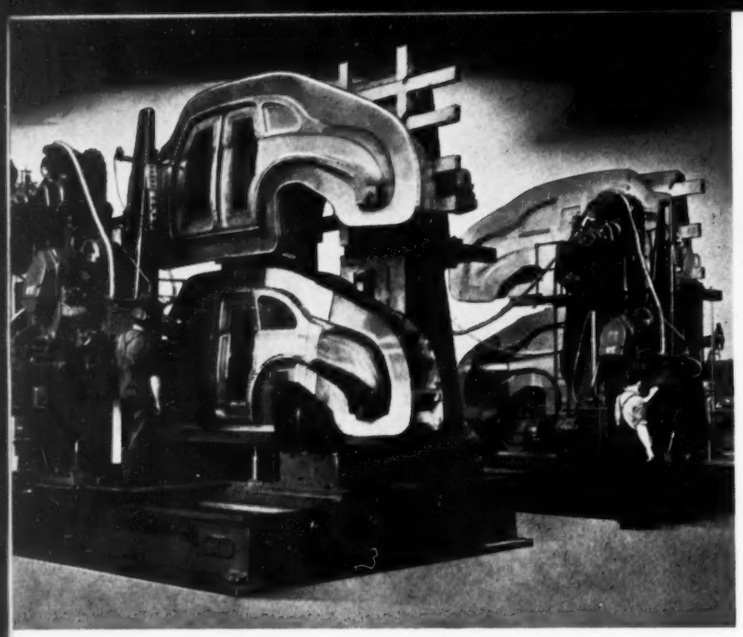


*Fig. 3. Two Keller Automatic Tool-room Machines Used for Producing Automobile Body Dies in the Australian General Motors Plant*

range from 60 to 100 surface feet per minute. The floor-to-floor time for the operation is 45 minutes.

Long spindles for lathes and milling machines are being ground in a shop in Bohemia on the Heald internal grinder shown in Fig. 2. This machine is provided with an extended bridge for the accommodation of long work. Spindles up to 31 1/2 inches long by 4 inches outside diameter can be ground, not only in the internal bores but also on tapered shoulders and on an external face. These grinding cuts can all be taken at the same set-up of the work.

The spindle being ground is supported at the outer end by a three-jaw chuck attached to the work-head, and at the other end by a pillow block. Both the work-head and pillow block are mounted on the swivel-plate of the extended bridge.

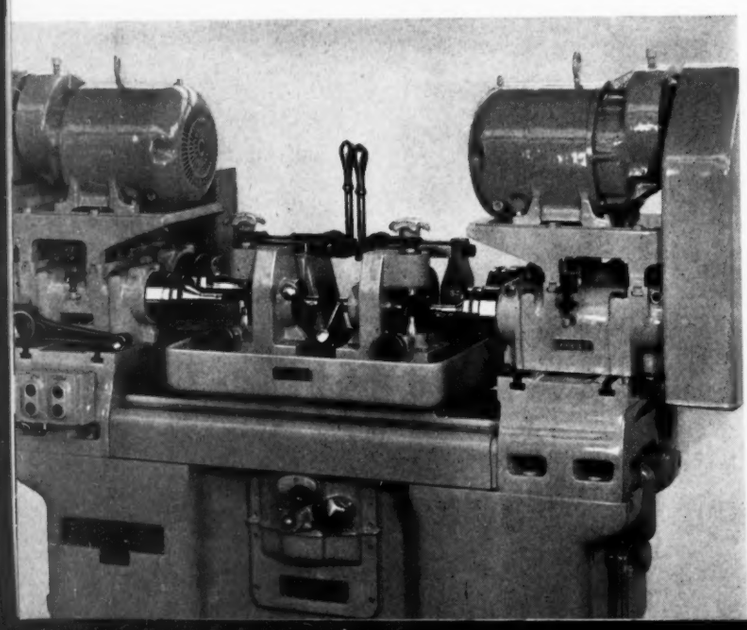
The external face on the end of the spindles is ground by means of a face-grinding attachment, mounted on the rear of the swivel-plate, which is fed vertically for the operation. Tapered shoulders are ground by the plunge-cut method, a formed wheel being used which is mounted on the horizontal spindle seen at the right. This wheel is fed to the work by means of the table feed. The same wheel is used for grinding straight bores.

Two Keller automatic tool-room machines installed in the General Motors plant in Australia for machining large automobile body dies from wooden models are illustrated in Fig. 3. As a stylus or tracer on an upright follows the contours of the model at the top of the work-supporting uprights, a milling cutter is automatically moved along a similar path on the die being machined.

Steel-forged connecting-rods are finish-bored at both ends simultaneously in a Swedish industrial plant by means of the Ex-Cell-O Junior double-end precision boring machine illustrated in Fig. 4. This machine is equipped with a two-station manually operated fixture, so that a part can be bored at one station while another part is being bored at the opposite station, the machine being so arranged that the table feeds alternately to the right and left for carrying connecting-rods to the heads on both ends of the machine. The hourly production is sixty connecting-rods, based on an efficiency of 80 per cent.

The connecting-rods are located at the small end with a locating plug. They are clamped on top by turning a ratchet hand-knob, and on the bottom by a spring jack. The large end of the connecting-rod rests on a ground pad and is clamped on the face by means of an equalizing strap.

*Fig. 4. Double-end Type of Precision Boring Machine which Finishes Both Bores of Connecting-rods Simultaneously in a Swedish Plant*



The large end of each connecting-rod is bored to a diameter of 2.436 inches with the spindle running at 140 R.P.M., while the small end is bored to a diameter of 1.045 inches with the spindle running at 324 R.P.M. Both spindles are fed at the rate of 0.016 inch per revolution and remove from 0.015 to 0.020 inch of stock on the diameter. The length of both bores is 1 5/8 inches.

Cams for aircraft engines are milled completely around their contour in the Commonwealth Aircraft plant at Melbourne, Australia, by the use of the Cincinnati vertical milling machine shown in Fig. 5. The same equipment is employed for rough-milling the contours on the large end of master rods, such as seen on the table in the foreground.

This milling machine is equipped with a 16-inch circular milling attachment on the knee instead of the regular saddle and table. The circular milling attachment is provided with upper and lower slides. The upper slide is adjustable by turning the hand-wheel on the regular cross-adjusting screw. Two air cylinders hold a cam mounted on the upper unit against a cam follower on the lower slide, so that as the table rotates, the cam and follower cause it to move in and out. In this way, the contour of the master cam is reproduced on the work.

In the operation on the master rods, stock to a depth of 3/16 inch is removed by a helical milling cutter 1 1/2 inches in diameter by 3 inches long, which extends across both flanges of the master rod. Three rods are rough-milled per hour.

Locomotive axle-boxes used by the South African Railways are milled on opposite sides simultaneously in the Johannesburg, South Africa, shops of this railway system, by employing the Cincinnati duplex Hydromatic milling machine shown in Fig. 6. The axle-boxes are of cast steel, and the bronze bearings to be milled are cast into channels in the boxes.

The table of the milling machine is equipped with a fixture that provides for milling both the straight and the tapered sides of the axle-boxes. For milling the tapered side, the fixture is tilted on a trunnion. Shell end-mills of J-metal, 4 1/2 inches in diameter, are used. Two passes of the cutters are made through each channel to complete the operation. One cut is taken while the table moves from right to left, and the second while the table is returning to the right.

Accurate and fast vertical adjustment of the spindle-carriers for taking the two cuts is made possible by special features incorporated in the

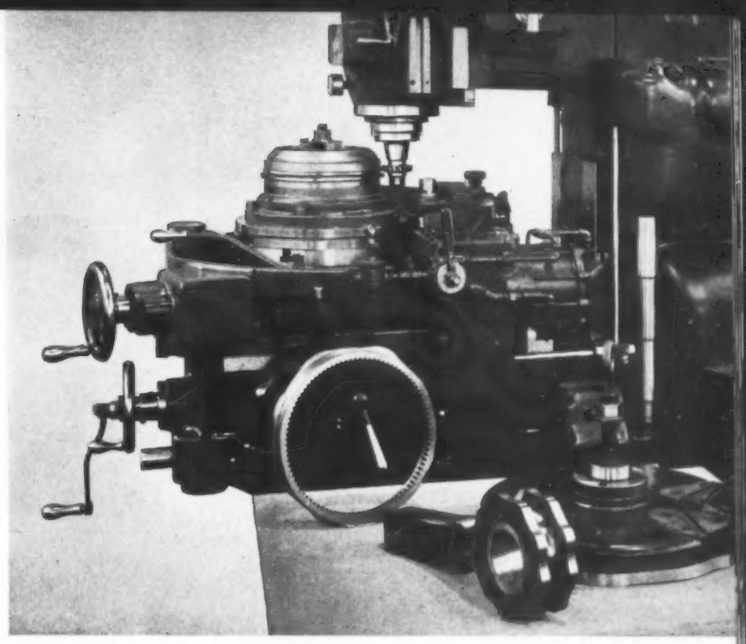
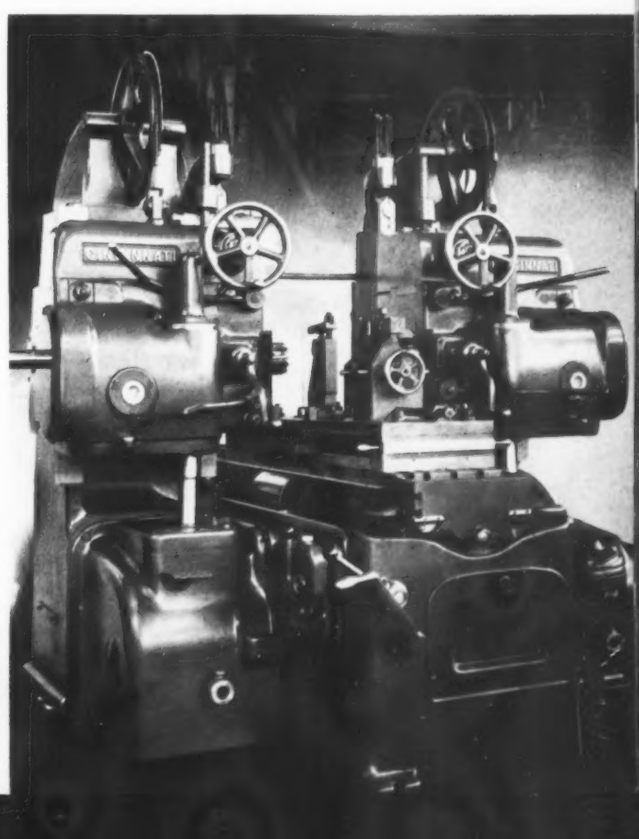


*Fig. 5. Cincinnati Vertical Milling Machine Employed in an Australian Shop for Milling Airplane Engine Cams and Master Rods*

*Fig. 6. Duplex Type of Milling Machine Employed in a South African Railroad Shop for Milling Two Sides of Locomotive Axle-boxes at Once*



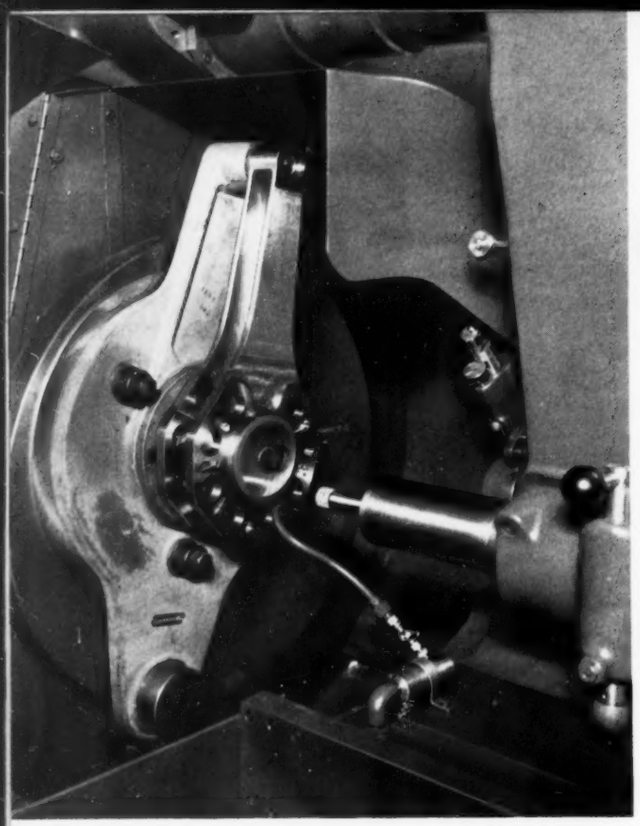


*Fig. 7. Grinding the Knuckle-pin Holes in a Master Connecting-rod at a Polish Plant by the Use of a Bryant Internal Chucking Grinder*

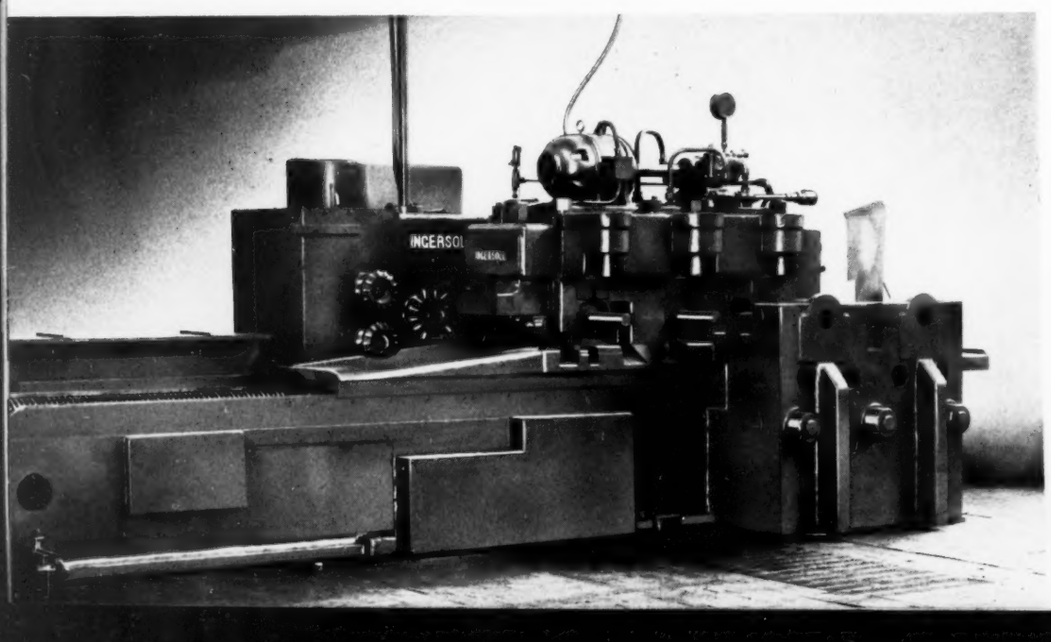
machine. Vertical adjustment of either spindle-carrier is obtained through a handwheel mounted on a dummy over-arm. An elevating screw is provided on this over-arm which engages a nut in a bracket fastened to the top of the machine headstock. A counterweight provided for each head facilitates adjustments. Accurate vertical positioning of each spindle-carrier is insured through a four-position turret stop on the headstock, together with an indicator on the dummy over-arm.

An example of the use of modern methods in building airplanes in Polish shops is seen in Fig. 7. This illustration shows a Bryant internal chucking grinder being employed for finishing the knuckle-pin bores of master connecting-rods. Sixteen bores are ground on each rod and two rods are completed per hour, the holes being ground true to size within 0.0005 inch.

The fixture is of an ingenious design that enables each pair of knuckle-pin holes to be successively positioned in line with the grinding spindle at one mounting of the work. The two knuckle-pin holes of each pair are of different diameters, varying by 0.005 inch. A special guide having a step is provided on the wheel-slide, so that the wheel is automatically advanced or retarded to suit the difference in these two diameters, making it unnecessary to alter the setting of the cross-feed handwheel. From 0.010 to 0.012 inch of stock on a side is ground from the knuckle-pin holes.

Modern high-production machine tools are not unknown in South America, as will be apparent from Fig. 8, which shows an Ingersoll milling machine shipped to one of the shops on our neighboring continent. This machine is used for scalping copper bars. One of the inserted-tooth milling cutters scalps the flat side of the bars, while the other two cutters are provided with formed inserted blades for rounding the nose of the bars.

*Fig. 8. Three-spindle Milling Machine Installed in a South American Shop for Scalping Copper Bars*



The grinding of thread gages in a plant in Poland is shown in Fig. 9 being performed on a Brown & Sharpe No. 2 surface grinding machine equipped with a special fixture of the indexing type. This fixture is provided with translating gears to suit either English or metric pitches. An angular truing device enables the grinding wheel to be dressed to the desired thread contour.

Locomotive piston-rods are finish-ground on the outside diameter in the Stratford, Ontario, shops of the Canadian National Railway after the pistons are assembled to the rods. This operation is performed in the Cincinnati grinding machine illustrated in Fig. 10, which is provided with a table having a gap near the headstock end to accommodate the large-diameter pistons. The machine has a nominal swing of 16 inches and receives work up to 120 inches between centers.

The use of a gap type table resulted in a considerable saving in the cost of the grinding equipment for this operation, as a standard machine with a swing large enough to accommodate the pistons would have been much more expensive.

Piston-pins of seamless steel tubing are broached internally at the rate of 1200 an hour by the Oilgear hydraulically actuated pull-down broaching machine shown in Fig. 11. This operation is being performed in the Walkerville, Ontario, plant of the Ford Motor Co. of Canada, Ltd. The piston-pins are 3/4 inch outside diameter by 2 25/32 inches long, and are broached to a hole diameter of between 0.5465 and 0.5475 inch. The cutting speed of the broaches is 30 feet a minute.

The work of the operator consists merely of loading the rough piston-pins into the four chutes that lead to the work-holding fixture, the finished parts being automatically ejected from a delivery chute on the left-hand side of the machine into a container. In operation, a shuttle carries four rough

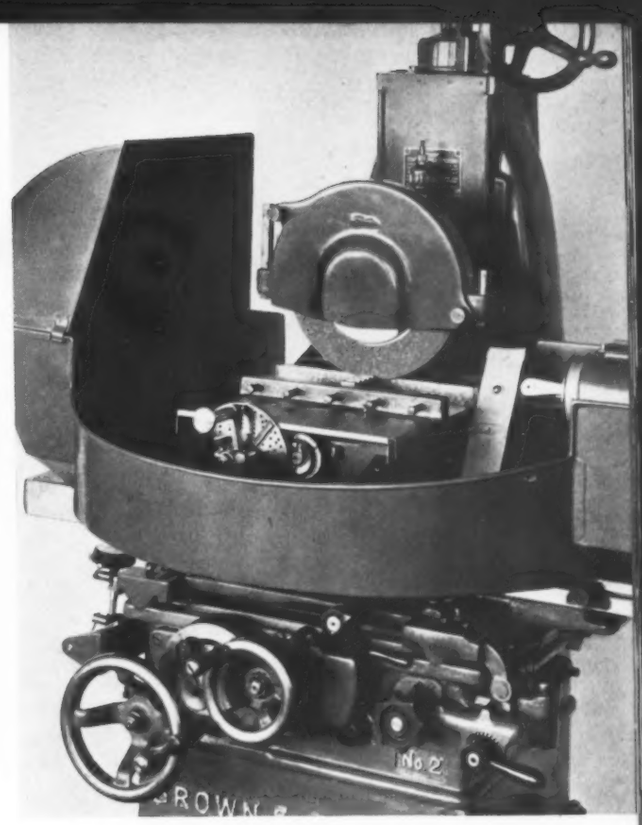
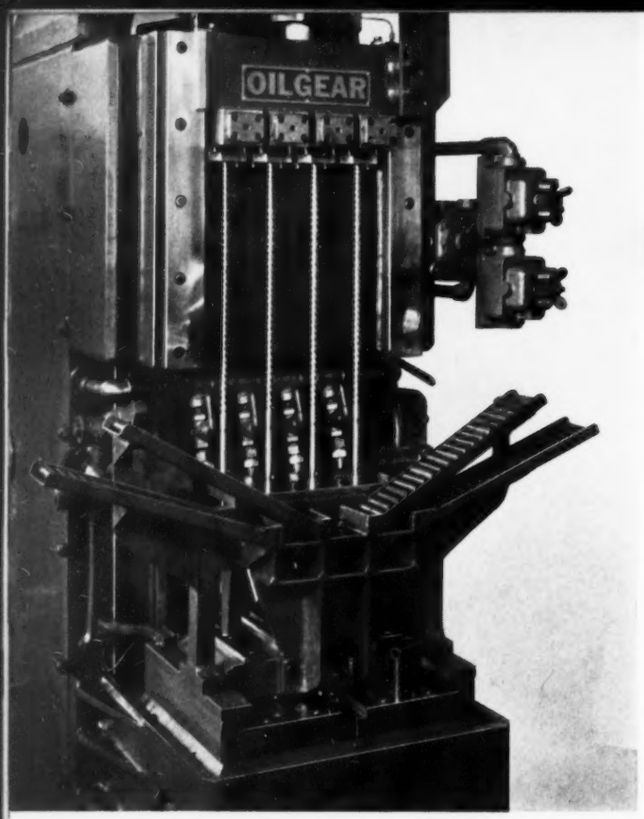



*Fig. 9. Surface Grinding Machine in a Polish Plant Equipped with an Indexing Fixture for Grinding Thread Gages and Similar Parts*

*Fig. 10. Grinding Piston-rods in a Canadian Railway Shop on a Machine Equipped with a Gap Type Bed*




pins at a time into the broaching position as the upper tool-handling slide moves downward to feed four broaches through the parts and into pulling sockets under the platen. The main slide and automatic pullers then pull the tools downward for broaching the parts.

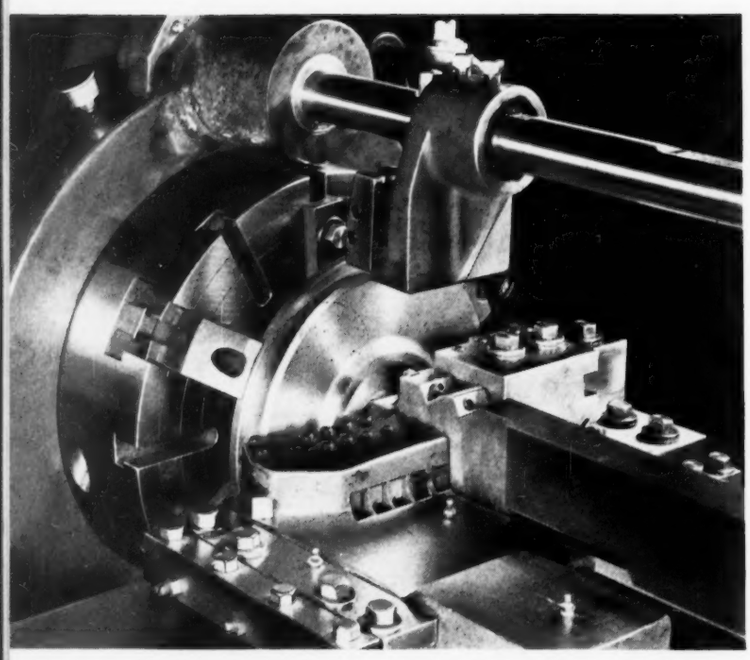
At the end of the broach movement, the shuttle carries the finished parts back to the unloading position, where they fall into the discharge chute, the main slide moves upward, the shuttle returns to the loading position, and the tools engage detent-holders and are carried up to their starting position by the upper cylinder and slide.

Flywheels and ring gears for automotive applications are machined in the Simplimatic lathe illustrated in Fig. 12, which was shipped to a shop in Poland by the Gisholt Machine Co. The operation shown is the second one performed on cast-iron flywheels, the work being chucked on a surface that is finish-turned in a preceding operation.

In the operation illustrated, six tools on the front slide are employed for rough-turning, boring, and facing cuts, while four tools on the rear slide finish-shave three surfaces and turn one diameter, and two tools on the piloted center slide chamfer the bore of the flywheel and size the counterbore. In addition, a tool on the overhead piloted bar, which is actuated from the center slide, sizes a ring gear surface.

Stellite J-metal tools are used for the entire operation. The feeds range from 0.005 to 0.037 inch. Two peripheral speeds of 55 and 100 surface feet per minute are used. The floor-to-floor time in this operation is four minutes.

Grinding operations on the stem of the intake and exhaust valves for airplane engines are performed on Norton machines in the shop of Armstrong-Siddeley Motors, Ltd., at Coventry, England. Fig. 13 shows one of these machines employed for grinding the large radius under the head



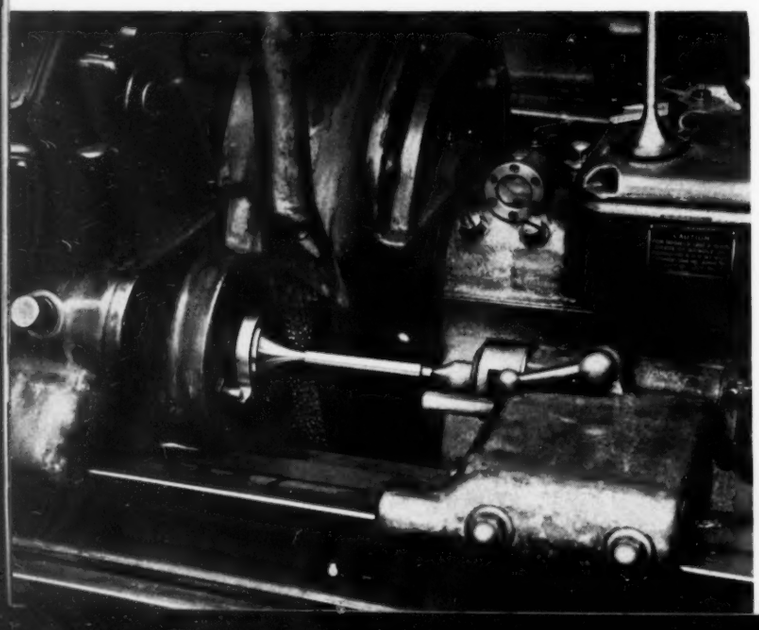


*Fig. 11. (Top) Broaching 1200 Piston-pins an Hour in the Plant of the Ford Motor Co. of Canada, Ltd.*

*Fig. 12. (Center) Finishing Flywheels for Automotive Applications in a Polish Shop*

*Fig. 13. (Bottom) Grinding Valve-heads for Airplane Engines in an English Plant*

of the intake valves. The 20-inch diameter grinding wheel is dressed to the desired curvature of the valve-stem. The work is supported by a center on one end, and by a driving member, which locates the part from the outside diameter of the head. The grinding wheel is fed straight into the work. The remainder of the stem is later form-ground.

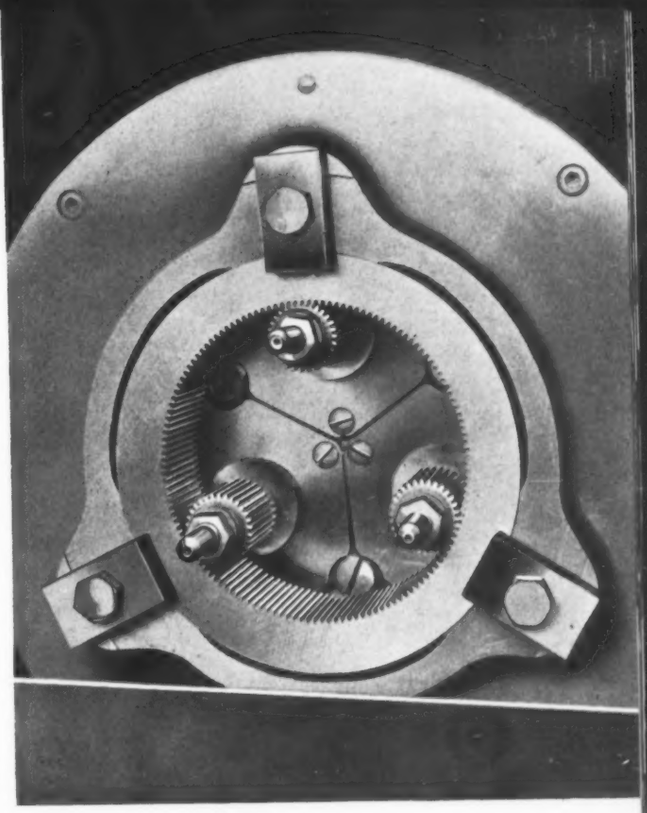
Small gears for cellulose-handling pumps are lapped eighteen at a time in the operation illustrated in Fig. 14, which is performed in an Italian machine shop. The lapping machine is of the planetary type built by the Fellows Gear Shaper Co. The lapping time does not exceed one-half minute.

Six gears mounted on each of three arbors rotate in mesh with a large internal lap, and, as they rotate, they are also reciprocated. The reciprocating action accomplishes the lapping, whereas the rotation serves to distribute the lapping compound. The gears are heat-treated to a hardness of about Rockwell 38 prior to cutting the teeth, and are lapped after the tooth-cutting operation without being removed from the arbors used in cutting the teeth. The gears must be extremely accurate, so as to pump the cellulose without any leakage.

An external grinding operation is shown being performed in Fig. 15 in an internal grinding machine shipped by the Heald Machine Co. to an airplane factory in Poland. The operation consists of grinding three pinion arms on a propeller reduction gear-shaft. The surfaces ground on each arm include a 1 3/8-inch diameter cylindrical surface, an adjacent shoulder, a 2-inch diameter cylindrical surface, and a 3/16-inch radius.

As the pinion arms project at an angle of 76 degrees from the shaft, the machine is equipped with an angular wheel-head cross-slide which permits of grinding each arm close to the shaft without interference between the work and the wheel.

The work is held in a fixture that is arranged to index the arms successively into the proper grind-



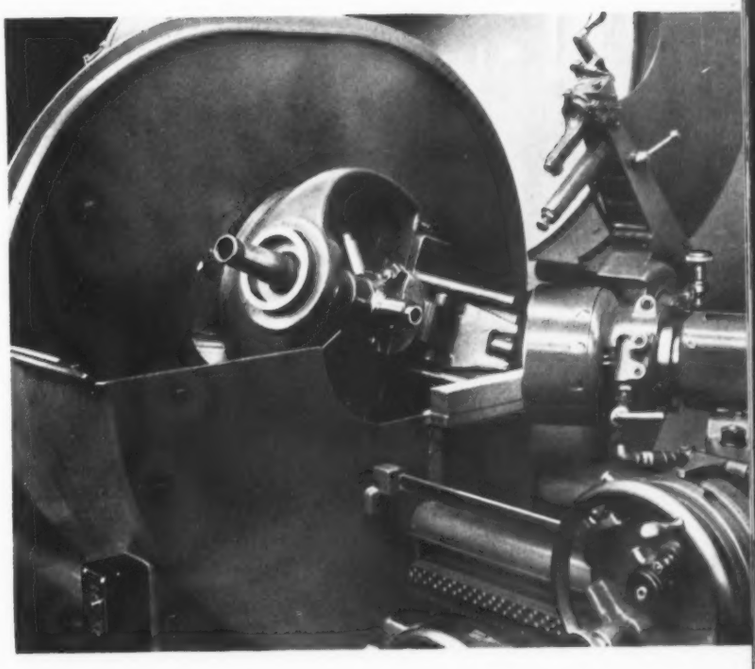


*Fig. 14. (Top) Lapping Eighteen Small Gears Simultaneously in an Italian Plant*

*Fig. 15. (Center) Internal Grinder in a Polish Plant Finishing Arms of Propeller Gear-shafts*

*Fig. 16. (Bottom) Cleveland Automatic Installed in the Plant of the Standard Motor Co., Ltd., Coventry, England*

*Fig. 17. Heat-treating Department in a Swedish Plant which Uses Micromax Recording and Controlling Instruments*

ing relation with the wheel. The shaft is located in the fixture at the arm end by an index-plate. It is located approximately at the outer end by a threaded support sleeve which is slipped over the end of the shaft and screwed lightly in place. The first of the arms to be ground is then lined up with the rotation axis by means of a pivoted gage, after which the shaft is clamped to the index-plate by means of three straps. By turning a screw, the index-plate is then locked in place and the support sleeve tightened, after which the work is ready for grinding the first arm.

After grinding the first arm, the support sleeve and index-plate locking screw are loosened and an index plunger is withdrawn from its seat, permitting the work and the index-plate to be rotated as a unit. Positioning of the second pinion arm is then determined by the indexing plunger.

Although each arm is finished completely in one setting, it is necessary to use two different wheels, one for grinding the 1 3/8-inch diameter and shoulder, and the other for the 2-inch diameter and radius. The wheels are attached to the spindle by means of collets that permit quick change-overs.

Heat-treating equipment in the Atlas Diesel Plant, Stockholm, Sweden, includes Micromax recording and controlling instruments manufactured by the Leeds & Northrup Co. These instruments may be seen in the background in Fig. 17.

Two Ex-Cell-O precision boring machines used in an Italian plant for machining aluminum pistons are seen in operation in Fig. 18. The machine at the left is equipped with a single-station fixture and two boring units for rough- and finish-boring wrist-pin holes from 7/8 inch to 1 3/4 inches in diameter in pistons of various sizes.

The indexing fixture is designed to accommodate various sizes of pistons through the use of interchangeable locating adapters, plugs, and clamps. The pistons are located either from the circumference or from the bore, and rest on the open end. The wrist-pin hole is aligned with the boring tools by means of a plug, as shown.

The fixture slide is indexed by a handwheel to



*Fig. 18. Two Precision Boring Machines of American Manufacture in Operation in the Piston Department of an Italian Industrial Plant*

bring each piston successively into the roughing and finishing positions. Adjustable stops at each end of the fixture furnish a means of insuring accurate positioning of the work in relation to the boring spindles. The feed of the table is automatically changed for rough- or finish-boring when the fixture is indexed, by the operation of a hydraulic valve at the rear.

Approximately 3/64 inch of stock on the diameter is removed in the rough-boring cut, and from 0.008 to 0.010 inch in finish-boring. The feed in rough-boring is 0.004 inch, and in finish-boring 0.0015 inch, with the cutter-spindle running at 3500 R.P.M.

The second Ex-Cell-O precision boring machine, shown at the right, is of a double-end style and is equipped with a single-station indexing fixture. The pistons are located in this machine with the skirt downward on a pilot ring, and they are aligned by means of a plug mounted on the front of the right-hand bridge. The piston is clamped on top. Rough-boring is performed by the front left-hand spindle, semi-finish boring by the spindle at the rear of the left-hand bridge, and finish-boring by a spindle on the right-hand bridge.

A battery of South Bend bench lathes of 9 inches swing installed in a modern shop in Buenos Aires, Argentina, is shown in Fig. 19. These lathes are all driven from one lineshaft, mounted underneath the bench. Vertical belts connect the lineshaft to a countershaft at the back of each lathe, and a horizontal belt is used between the countershaft cone pulley and each lathe cone pulley. This arrangement eliminates overhead belts, shafting, etc.

*Fig. 19. Battery of South Bend Bench Lathes in an Argentine Shop Driven as a Group from a Lineshaft beneath the Bench*

Perhaps the most novel application of American-built machines in this entire article is that presented in Fig. 20, which shows a shop view in the factory of John A. Oya & Co., Honolulu, Hawaii. This concern manufactures curios and novelties from Hawaiian hardwood, cocoanut shells, and mother of pearl. The products include fancy perfume containers, wooden trays, buttons, belts, and bracelets. Extensive use is made in this shop of Delta drilling machines, saws, sanders, etc.



*Fig. 20. General View in a Hawaiian Shop which Uses a Considerable Number of Light American Machines in the Manufacture of Novelties*

# American Machines

*The Thames and the London Tower Bridge—Courtesy, Travel and Development Association of Great Britain and Ireland*

***First Installment of an Article Illustrating Some of the Many Applications of American-Built Metal-Working Machines in the Manufacturing Plants of England—the Best Customer of Our Machine-Building Industry in 1939***

THE large volume of metal-working machinery shipped from our shores to England during the last few years helped substantially to prepare Great Britain's industries for the war that is now in progress. In 1937, the United Kingdom, including England, Scotland, Wales, and North Ireland, was our best customer for machinery of this classification, the total value of the machines purchased amounting to almost $20,000,000, according to statistics compiled by the Department of Commerce.

In 1938, our exports of metal-working machinery to the United Kingdom dropped to $15,000,000, but estimates indicate that our business in that market increased during 1939 to the all-time high of $30,000,000, and it should be borne in mind that this figure is exclusive of machinery sent to other regions of the British Empire, such as Canada, Australia, South Africa, and British India. Back in 1934 and in the 1920's, the United Kingdom was also our best customer for machine tools and other metal-working machinery, although in those years the maximum never reached $9,000,000.

Large numbers of American-built machines installed in England's metal-working plants are engaged in turning out airplanes, munitions, and ordnance to meet the needs of a warring nation, but they are also manufacturing automobiles, tractors, telephone equipment, and other products intended for peacetime pursuits. This article will present numerous illustrations of American-built metal-working machines in action in England's busy shops.

Cylinder liners for the Diesel engines made by Ruston & Hornsby, Lincoln, England, are honed by the machine illustrated in Fig. 1, which was built by the Barnes Drill Co. In handling cylinder liners 12 1/2 inches in diameter by 34 inches in length, as shown, from 0.005 to 0.008 inch of stock on the diameter is removed in 8 minutes, floor-to-floor time. Hones of 300 grit are employed.

This honing machine has a higher column and a longer spindle travel than standard machines. Fifty inches of spindle travel are available, and the yoke was inverted so as to permit the spindle itself to go deep into the bore of the cylinder liner. This enables hones having short shanks to be used. The height of the machine is 18 feet 9 inches.

# in England's Busy Shops

The machine is equipped with a large hinged type of hone guide bracket, and bushings were supplied for every diameter of cylinder liner made by the concern. The bracket has a hollow jacket through which coolant is fed, and the steel bushings have many orifices drilled through them that lead the coolant directly to the work without splash. The machine was also provided with a special base that travels in and out beneath the hone guide bracket and the bushing, for convenience in loading and inspecting the work. An air-actuated counterbalance offsets the weight of heavy hones.

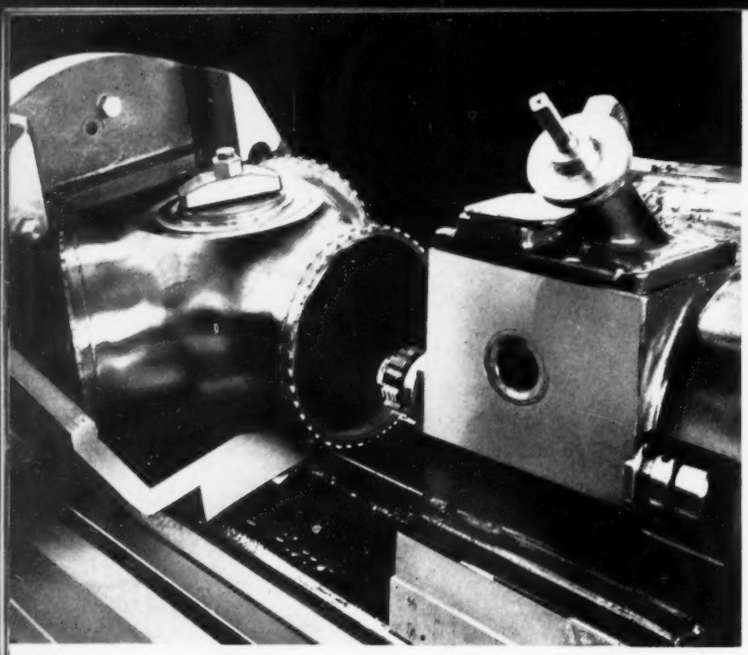
One of the most progressive manufacturing plants in England was recently established by the Standard Motor Co., Ltd., in Coventry. Fig. 2 shows a high-production operation performed in that plant, which consists of surface broaching four faces of automobile cylinder blocks. The operation is performed on a Lapointe hydraulically actuated double-acting machine of vertical design. The two broach slides travel in opposite directions, so that while one broach is descending for the cutting portion of its cycle, the other is making its return stroke, and vice versa.

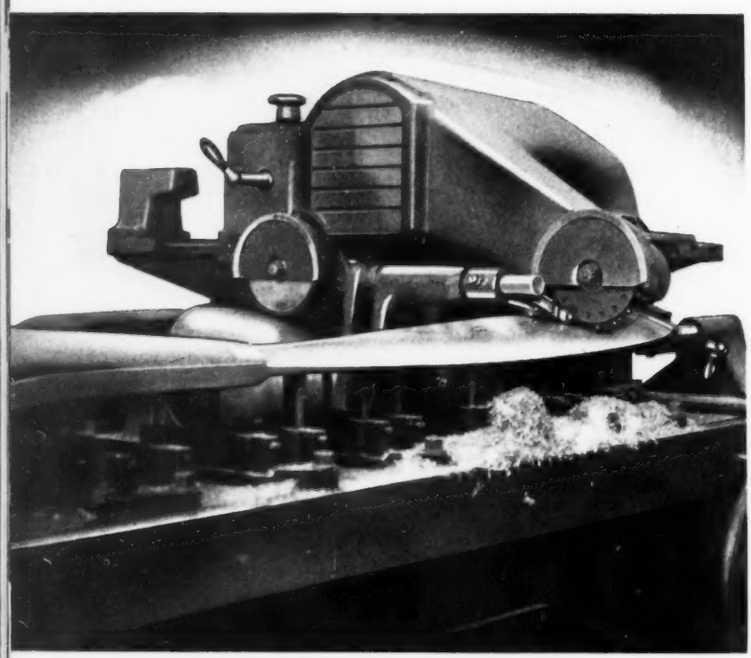
The broach on the right-hand side of this machine faces the two ends of the casting, while the broach seen in the raised position at the left finishes the top and bottom of the blocks. The fixture on the right-hand side is indexed through 180 degrees to swing the work into line for broaching the second end after the first end has been finished, while the casting is turned end for end on the table at the left-hand side of the machine for broaching the top and bottom. Stock to a maximum of 5/32 inch is removed from the various surfaces of the cylinder blocks.

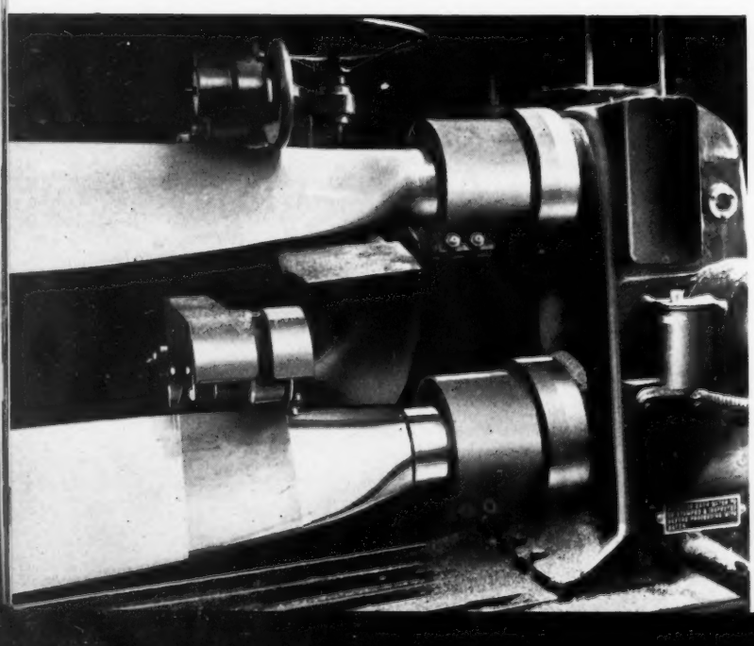
Each of the two broach-holders carries forty-nine sections, there being forty-eight roughing sec-

*Fig. 1. (Top) Barnes Honing Machine Imparting a Fine Finish to Large Cylinder Liners in an English Plant*

*Fig. 2. (Bottom) Two-station Hydraulically Operated Machine Employed for Surface Broaching Four Faces on Cylinder Blocks for Automobiles Built by Standard Motor Co., Ltd.*







tions, and a finishing section at the top that is provided with transverse teeth machined at an angle. The roughing sections are each 1 inch wide, and are arranged in four sets, one above the other, each set comprising twelve sections or blades of eight or ten teeth each. There are thus twelve vertical rows of teeth for roughing. The broached surfaces are free from chatter marks and are flat within 0.002 inch.

Hubs for airplane propellers, or airscrews as they are called in England, are threaded internally in the plant of Rotol Airscrews, Ltd., Gloucester, by the use of the Hanson-Whitney thread milling machine shown in Fig. 3. The machine is equipped with a cradle type of fixture for holding the work, the hub being revolved at a surface speed of 72 feet per minute.

The dimensions of the buttress thread which is milled in the three hub bores are checked by means of "Go" and "Not Go" gages. The form is inspected by means of sulphur-graphite castings made from each hub, which are enlarged on a screen for comparison with a master profile. There are 10 threads per inch.

American-built machine tools are used in other operations on the same hubs and also on the blades. For example, Fig. 4 shows a Berliner profile milling machine, built by the Engineering & Research Corporation, which is employed after the hub end of the blade has been centered and rough-turned. The revolving cutter of this machine passes back and forth over the face of the blade while the table is fed longitudinally past the cutter.

The profile of the blade is controlled by means of a rotating cam which revolves once for each complete traverse of the table. This cam causes the milling cutter to be moved up and down in

***Fig. 3. (Top) Milling a Buttress Internal Thread in Each of the Three Bores in the Hub of Rotol Airscrews or Propellers***

***Fig. 4. (Center) Equipment Employed in Profile Milling Both the Flat and Cambered Surfaces of Rotol Propeller Blades***

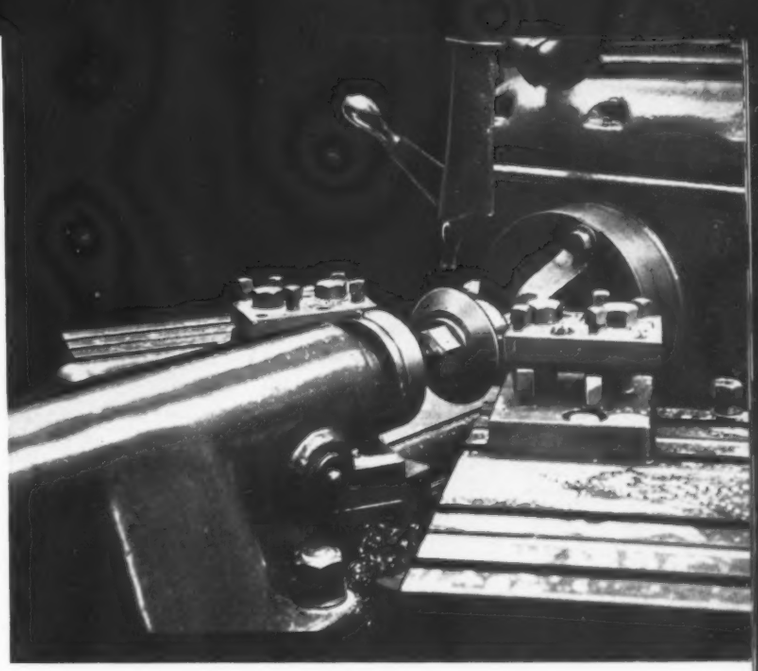
***Fig. 5. (Bottom) Profile Milling the Root End of Rotol Propeller Blades in a Machine Equipped with a Master Blade for Controlling the Cutter Movements***

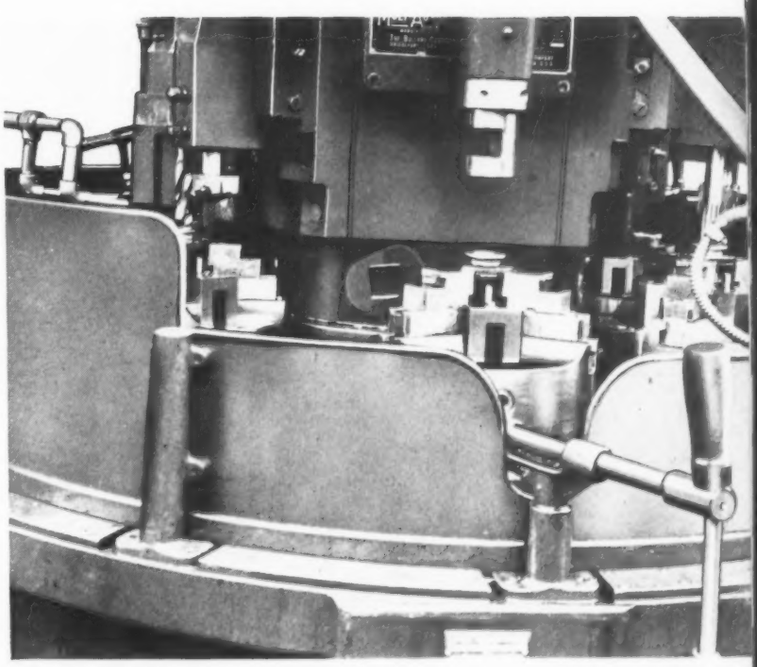
accordance with the desired profile, the cam having been developed from a master propeller blade of the desired shape. The cutter is of the inserted-blade type, and is 8 inches in diameter. It runs at a surface speed of 5500 feet per minute, while the blade moves longitudinally at the rate of 3 inches per minute. One side of the blade is flat, and this is milled first in order to provide an accurate locating surface for use in machining the cambered profile of the opposite side.

After the blade has been milled as far as the root section, it is passed to the Sundstrand Rigidmil shown in Fig. 5 for profiling the remainder of the blade to the hub end. A master blade is located on this machine above the work, and a roller that follows the contour of the master blade controls the movements of the revolving cutter beneath. The blade and master revolve synchronously, and the carriage on which the cutter and follower are mounted is free to move in a vertical direction. Both roughing and finishing cuts are taken on this machine.

The next operation on the blade consists of milling the edges on another Sundstrand Rigidmil, which is provided with two helical milling cutters that operate simultaneously on the upper and lower edges of the blade. This operation removes the knife edges remaining at the end of the Berliner profile milling operations.

A Lodge & Shipley Duomatic lathe is shown in Fig. 6, engaged in finish-turning the face and cone surfaces of bevel gears for use in farm tractors built by the David Brown Tractors, Ltd., Park Works, Lockwood, Huddersfield. Carbide-tipped tools are used in machining this high-tensile nickel-chromium steel forging. With this equipment, the two conical surfaces are machined in a floor-to-





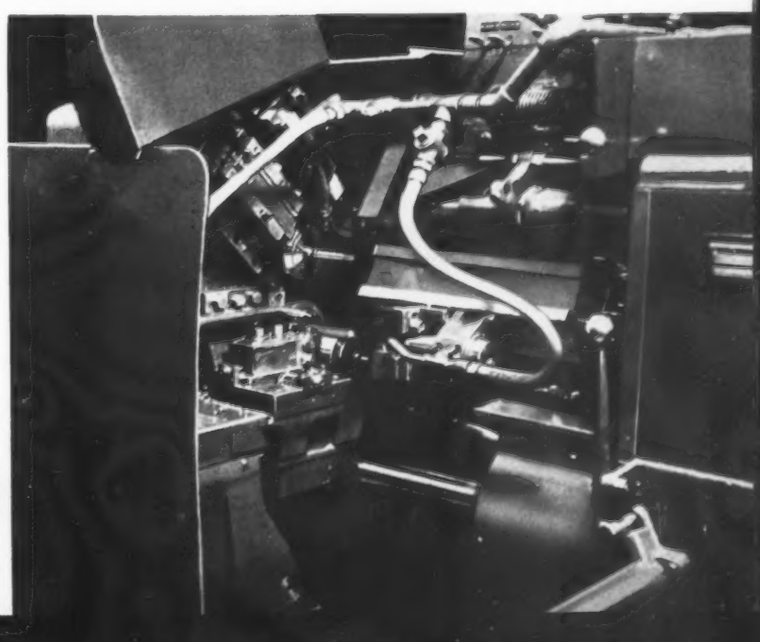


*Fig. 6. (Top) Machining Bevel Gears for David Brown Tractors in a Lodge & Shipley Duomatic Lathe*

*Fig. 7. (Center) Machining Tractor Transmission Gear Blanks Progressively in the Six Stations of a Bullard Mult-Au-Matic*

*Fig. 8. (Bottom) Bolts for Holding Tractor Differential Casings together are Produced by This Six-spindle New Britain-Gridley Automatic*

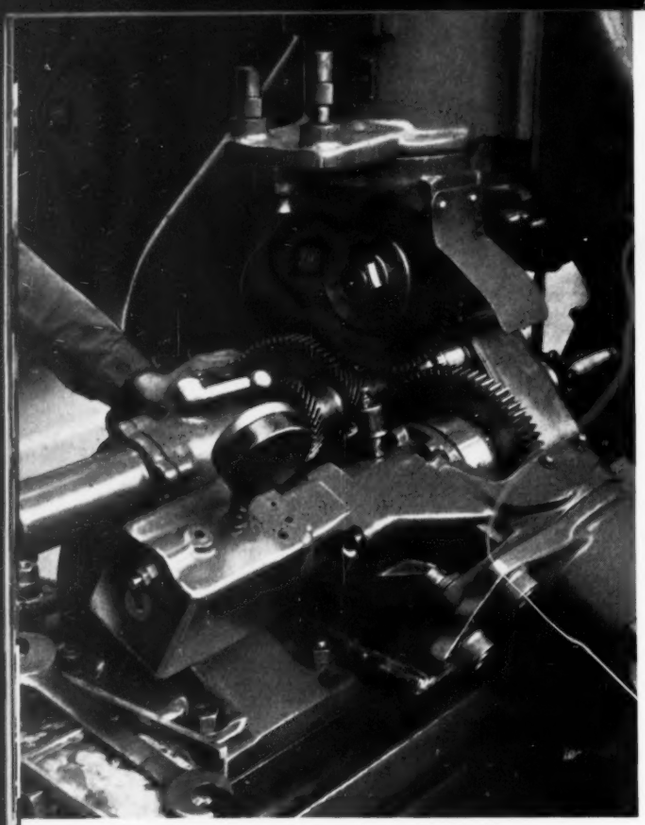


*Fig. 9. Lapping Gears for Morris Automobile Engines in a Machine Built by the Michigan Tool Co. which Reverses and Stops Automatically*

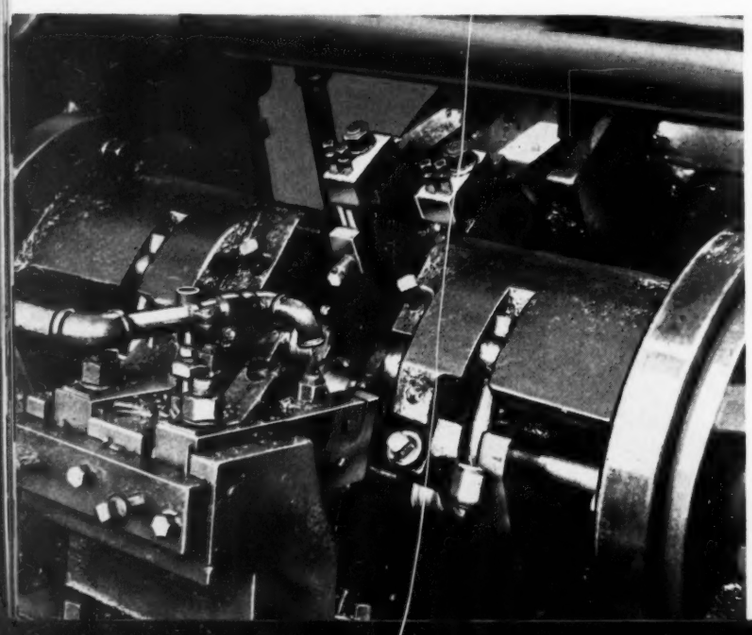


*Fig. 10. Crankshaft Lathe of American Manufacture Employed for Machining the Pin Bearings of Crankshafts for Morris Automobile Engines*

floor time of five minutes. In a subsequent operation, seventeen teeth of 0.924 inch circular pitch are cut on these blanks.

Another American machine in the same shop is the Bullard Mult-Au-Matic illustrated in Fig. 7, which is employed for machining solid blanks of carbon-chromium steel for transmission gears. Twenty-two teeth of 7 diametral pitch are later machined on these blanks.

The loading and unloading station of the Mult-Au-Matic is seen at the front in the illustration. At the next station to the left a hole 1 13/64 inches in diameter is drilled in the center of the blank and the diameter is simultaneously rough-turned. At the third station, the upper side of the blank is rough-machined, an inside edge is chamfered, and the gear face is turned. At the fourth station, the blank is bored to within 0.004 inch of the finished size, ready for reaming, and the outside of the boss is chamfered. At the fifth station, the upper face is finished and a selector-lever groove is roughed out. Finally, at the sixth station, the hole is reamed to size and the boss is finish-turned. The total time for all of these operations is 3 minutes 40 seconds.

The machine is fitted with a counter for registering the total number of parts machined, and also with a mandrel press that facilitates mounting the blanks on splined mandrels and removing them. Front and rear axle hubs are also machined on this Mult-Au-Matic.

In Fig. 8 is shown a close-up view of a New Britain-Gridley automatic employed for producing the bolts used for fastening together the two halves of the Brown tractor differential casings. These bolts are 7/16 inch in diameter by 3 3/4 inches long, and are made from 0.45 to 0.50 per cent carbon-chromium steel. The production time is three minutes per bolt.

When the Morris Motors, Ltd., established its new plant at Courthouse Green, Coventry, for the manufacture of automobile engines and transmissions, equipment made by the Michigan Tool Co. was installed for shaving, lapping, and inspecting gears. In Fig. 9 is shown one of the machines used for lapping gear teeth, the gear being revolved between three cast-iron laps to which abrasive compound is applied. The laps are each 7 inches in diameter, the upper lap being raised for reloading.

The work is driven at a speed of 180 R.P.M., and at the same time is given an axial stroking

motion at the rate of 90 reciprocations per minute. Lapping is performed in one direction for 20 seconds, after which the rotation of the work is automatically reversed and lapping is continued for another 20 seconds. The machine stops automatically at the end of this time. A cam controls the time cycle, and if desired, the lapping time can be extended to two minutes in each direction before the machine stops.

Oil-pumps build up a pressure of 100 pounds, exerting a load on the laps that tends to prevent their rotation, but this pressure can be varied to suit conditions. As a general rule, the cast-iron laps have a life of from 8000 to 10,000 gears.

Crankshaft lathes built by the R. K. LeBlond Machine Tool Co. are used in the same plant. The Nos. 1 and 4 crankpins of each crankshaft are machined in one lathe, and the Nos. 2 and 3 crankpins in a second machine. The latter operation is illustrated in Fig. 10. The two operations are almost identical, except for the fact that the positions of the tool-blocks are different. In both operations, the front and rear tool-slides are fed directly into the work at right angles to its axis. Each crankpin is operated on by a form tool on the front slide and a two-bladed form tool on the rear slide. The rear slide operates after the front slide, and finish-faces the crankpins to the desired length.

That huge presses, as well as smaller metal-working machines, are shipped by American builders to foreign countries is shown by the huge Clearing press illustrated in Fig. 11, which is in operation at the Austin Motor Co., Ltd., Birmingham. This press is used for producing the stainless-steel manifolds used on Bristol airplanes. It is of 1000 tons capacity, double-acting type, and is equipped with a pneumatic die cushion.

Type bars for a portable typewriter manufactured by the Imperial Typewriter Co., Ltd., Leicester, are blanked from coiled stock by the Bliss automatic press shown in Fig. 12. Approximately 250 pieces are produced per minute from hard rolled spring steel having a hardness of 42 Rockwell C. About 50,000 pieces are obtained per grind of the dies. Small gear teeth are blanked along one edge of the part.

The second installment of this article, which will show many additional applications of American-built metal-working machines shipped to English shops, will appear in an early issue of MACHINERY.

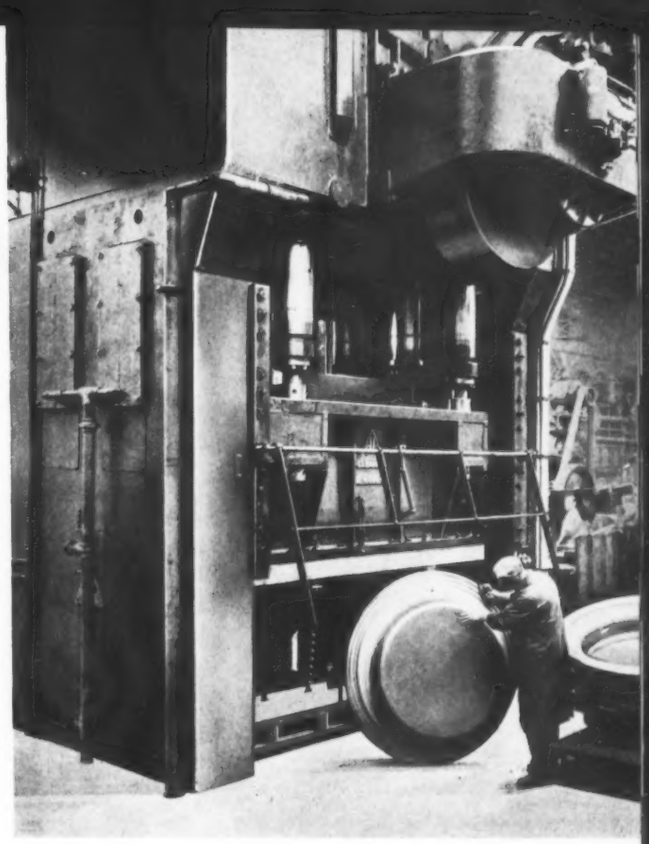


*Fig. 11. Producing Manifolds from Stainless Steel for Bristol Airplanes in a Clearing Press which has a Capacity of 1000 Tons*

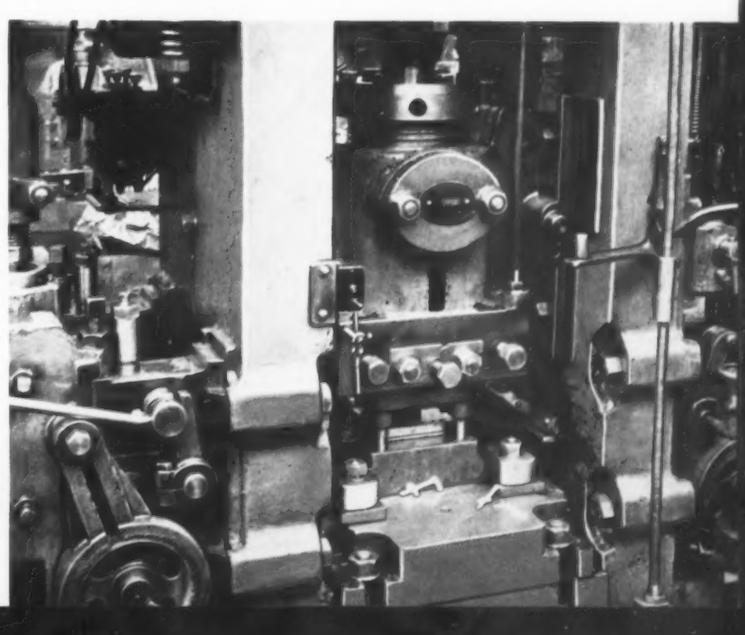


*Fig. 12. Bliss Press Used in the Plant of the Imperial Typewriter Co., Ltd., for Blanking Type Bars at the Rate of 250 a Minute*

# Modernized French Factories

THAT French machine shops have recognized the merits of American-built metal-working machinery is attested by the large volume of orders placed with American manufacturers during recent years. Both in 1937 and 1938, machinery of this classification to a value of over $5,000,000 was shipped from our harbors to France, and approximately $4,000,000 might be considered the yearly average since 1923. The estimate for 1939 is as high as $24,000,000.

These machines went largely for the modernizing of Government and private shops, to enable them to manufacture automobiles, airplanes, and other products at rates comparable to those obtained in the shops of the United States. The high quality of American machines has been another important factor in obtaining this business, because, generally speaking, the cost of American-built machines has been appreciably higher than machines from competing countries. This article shows operations being performed on many of the machines shipped to France in the last few years.

Universal-joint pins are being ground in a French automotive plant to size within 0.0006 inch, and round and straight within 0.0001 inch, in the Cincinnati centerless grinding machine illustrated in Fig. 1. Two operations are performed, about 0.012 inch of stock being removed in roughing and 0.003 inch in finishing. The average production is fifty pieces an hour.

The machine is equipped with a special in-feed work-rest and a hinged loading mechanism. Sheet-metal guards are provided over the grinding and regulating wheels to protect the operator.

The work-piece is laid in a support cradle attached to a hinged member, the handle of which is seen projecting toward the front of the machine. This handle is shown in the loading position, where it is normally held by a spring. The lever has a large arc movement to permit the pins to be lowered to the work-rest without interference from the grinding and regulating wheels. The unground ball section of the pins enters a clearance space between the wheels and the work-rest blade.

The loading lever is held down by the operator during the grinding action, so that the work is free to ride on the work-rest blade. At the end of the grinding operation, the lever returns to the position shown, so that the operator can conveniently remove the ground piece and replace it with an unground pin.

Drawing operations on sheet-metal parts for airplanes are accomplished in the Potez airplane factory in France through the use of wooden dies and rubber pads in the double-action press seen in Fig. 2. This press, which was built by the Lake Erie Engineering Corporation, has a capacity of 675 tons. The approach stroke is at the rate of 210 inches a minute, with the press driven by a 75-H.P. motor. Another Lake Erie press installed

*Dock at Havre—Courtesy of the French Line*

in the same plant for blanking operations employing rubber pads in combination with wooden dies has a capacity of 2500 tons.

In Fig. 3 is shown one of a battery of Potter & Johnston automatics installed in a prominent airplane plant for machining propeller hubs. The particular machine illustrated is used for machining the three arms, which are indexed successively toward the turret tools as each arm is completed.

Tools on the first turret face turn the end of the arm to a diameter of 50 millimeters (1.969 inches), after which the turret is indexed and tools on the second face rough-trepan to a diameter of 170 millimeters (6.693 inches) and bore to a depth of 40 millimeters (1.575 inches). At the same time the large-diameter hub is rough-turned and rough-faced by tools on the cross-slide.

Tools on the third turret face then take a second trepanning cut on the 170-millimeter diameter and bore to a depth of 65 millimeters (2.559 inches). Tools on the fourth turret face next rough-turn the taper of the arm, finish-face the end of the hub, and finish-face the hub shoulder. Finally, tools on the fifth turret face trepan the bottom of the large bore. The tools on each turret face are accurately aligned with the work by a pilot tongue which enters a mating groove on a bracket fastened to the cross-slide.

At the end of these cuts on one arm, the work is indexed to bring the next arm into position for machining. The total machining time on one arm is 1 hour 27 minutes, and the average floor-to-floor time per propeller-hub forging is 4 hours 37 minutes.

The Citroen automobile plant in France employs the Hall Planathreading machine illustrated in Fig. 4 for milling threads in the propeller-shaft bore of differential carriers. Before this method was adopted, considerable difficulty was experienced in cutting the threads true with the center line of the bore, as the work was readily distorted.

The malleable-iron differential carrier is mounted on a vertical surface plate which is connected to an air cylinder at the right-hand end of the machine. With the surface plate drawn away from the head of the machine, as shown, the differential carrier is loaded in position for chucking. Air is then applied in the air cylinder to move the surface plate and work forward over the revolving thread mill-

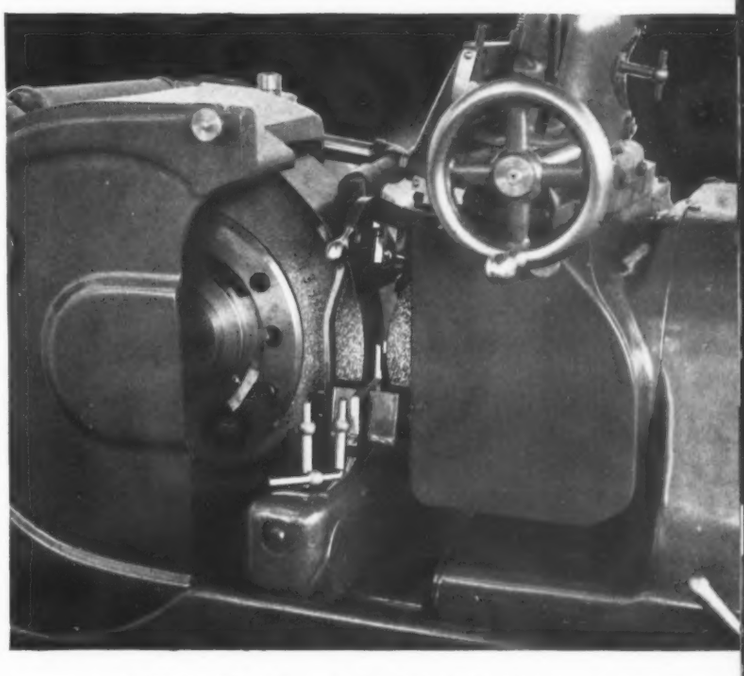
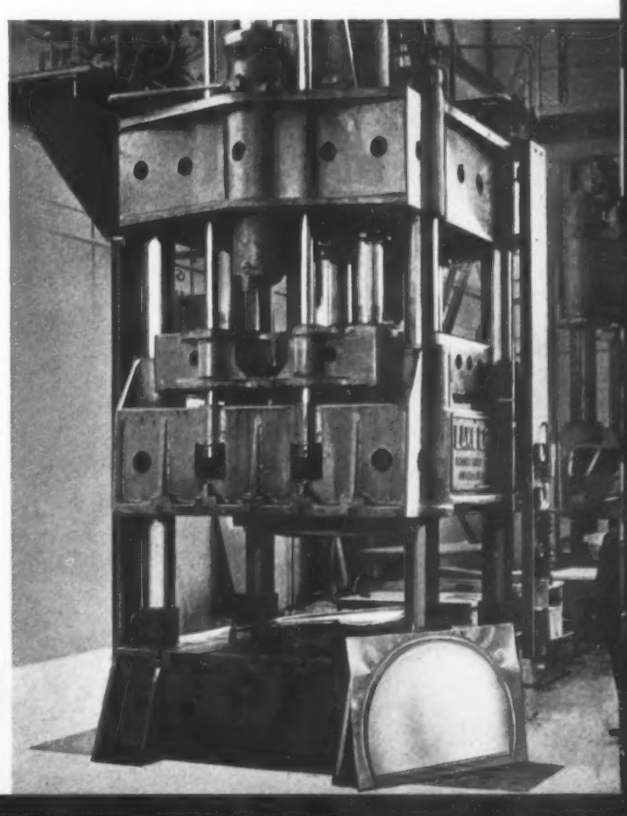
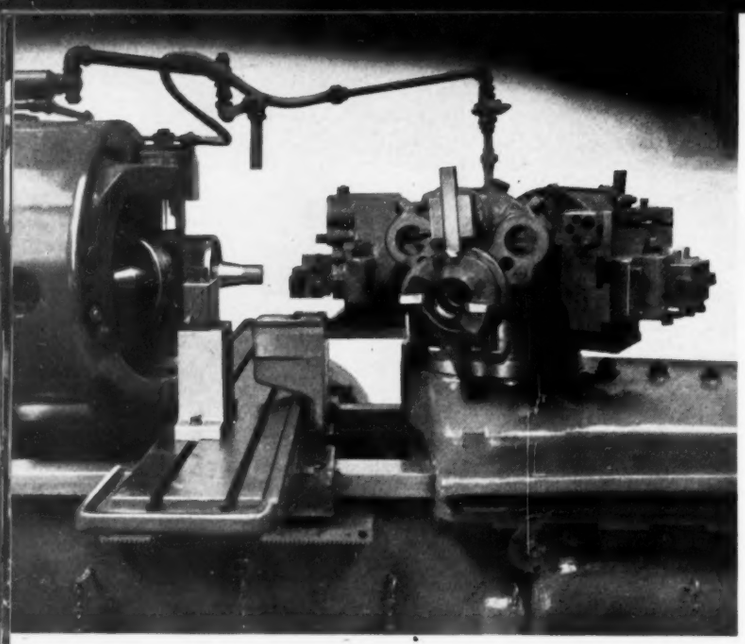
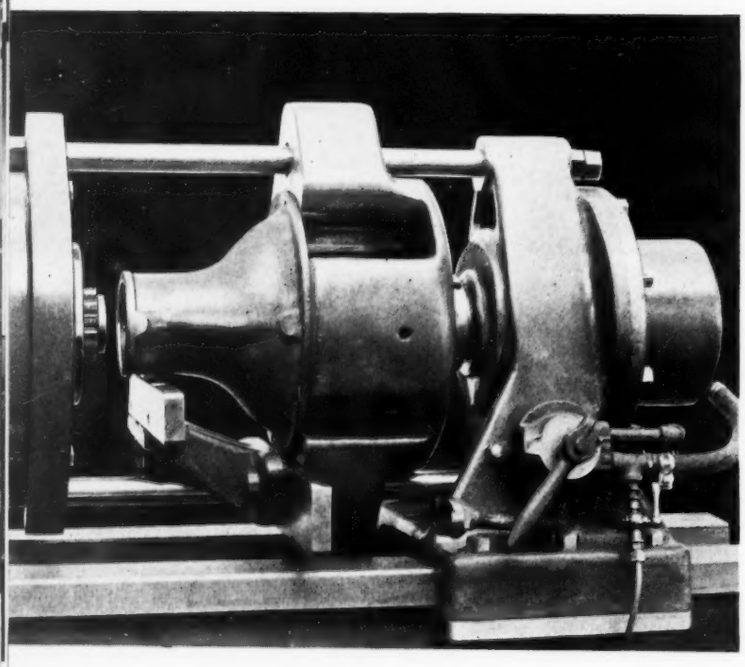


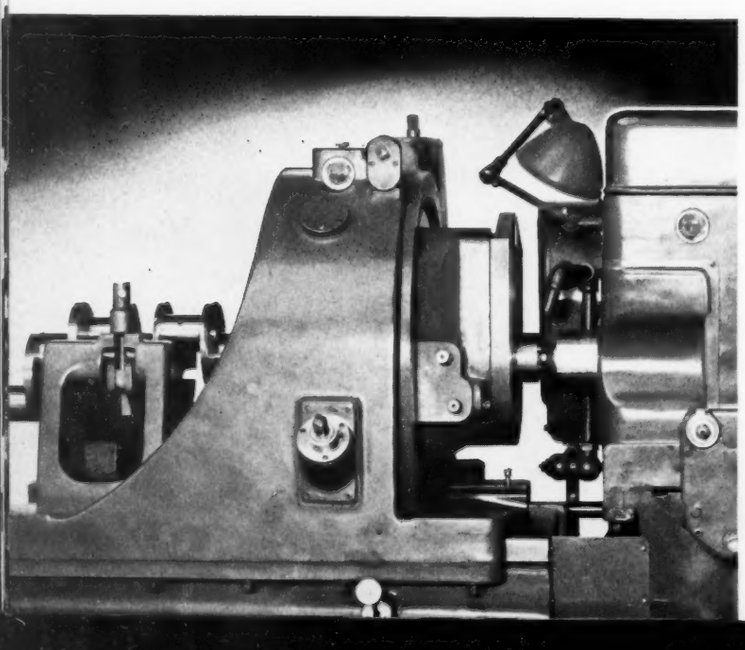
*Fig. 1. Grinding Cylindrical Surfaces on Universal-joint Pins with a Centerless Grinding Machine in a French Shop*

*Fig. 2. Press of American Manufacture Used in Forming Aircraft Sheet-metal Parts with Wooden Dies and Rubber Pads*









ing cutter and to locate the left-hand end of the casting in a hardened and ground taper ring provided in the faceplate of the machine. This method of chucking insures rigid holding of the work.

The threads are milled within a tolerance of plus or minus 0.001 inch in 30 seconds floor-to-floor time. The thread is milled with the planetary approach.

Internal splines are being cut in the end of a crankshaft for Hispano Suiza airplane engines in the operation illustrated in Fig. 5, which is performed on a Fellows horizontal Z model gear shaper. This machine was specifically designed for cutting spur or helical teeth on gears and clutches that are integral with long shafts. The front end of the work is held in an adapter mounted in a spindle which has a hole 18 inches in diameter in it. The outer end of the work, which extends toward the left, is supported by a bracket on a slide that is adjustable along the machine base for positioning the work in relation to the cutter.

The cutter-spindle is contained in a head which is adjustable along the base in a direction at right angles to the work-slide; this adjustment controls the diameter setting of the cutter with relation to the work.

The method employed in a French airplane engine plant for grinding the large fillet that extends from the under side of the head on tappet valves to the stem is illustrated in Fig. 6. An important requirement in this operation is that the fillet must blend so accurately into the straight stem that the point of blending cannot be detected. This operation is being performed on a Landis 10- by 18-inch Type C grinding machine, which is of standard construction, except for the fact that the wheelbase is positioned at an angle.

*Fig. 3. (Top) One of a Battery of Potter and Johnston Automatics Used for Machining the Arms of Propeller-hub Forgings*

*Fig. 4. (Center) Equipment Used for Milling the Threads in the Propeller-shaft Bore of Differential Carriers for Automobiles*

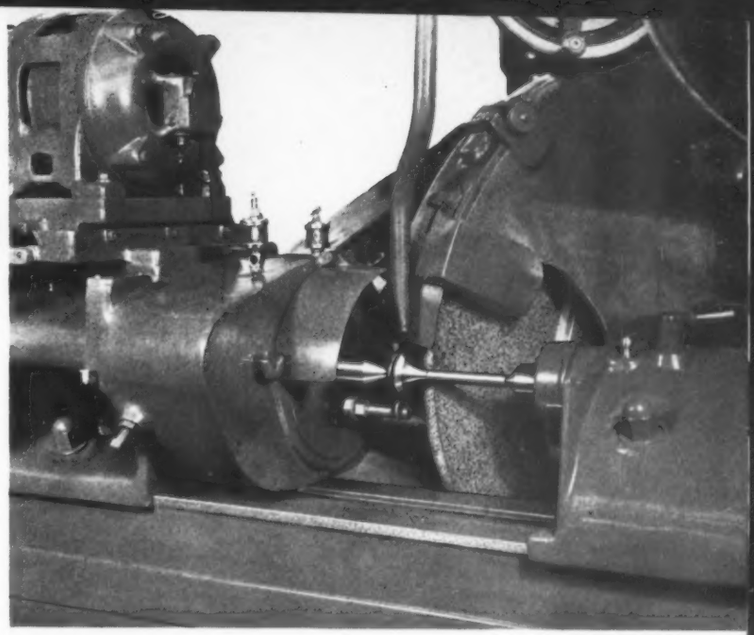
*Fig. 5. (Bottom) Horizontal Type of Gear Shaper being Used for Cutting Splines in One End of an Airplane Engine Crankshaft*

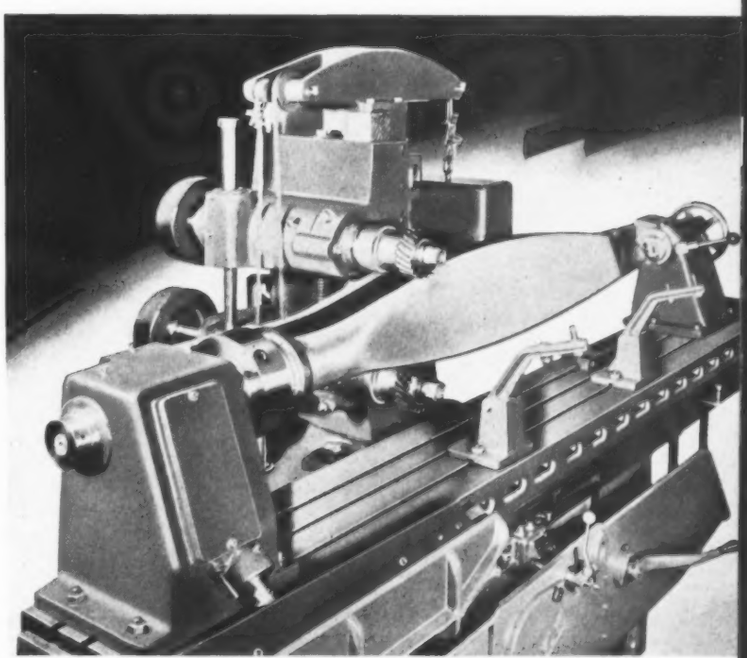
The valves can be held between centers in this operation, because a small centered boss is left on the head end until the completion of all grinding operations. This enables a dog to be used on the head end for driving in the conventional manner. The face of the grinding wheel is dressed to the required radius by means of a table type radial truing fixture, which is removed from the table of the machine when not in use.

Propeller blades in an airplane shop are being milled on the trailing and leading edges simultaneously by the Sundstrand Rigidmil illustrated in Fig. 7. The fixture of this machine is designed to accommodate propeller blades of various lengths and pitches. A removable profile cam located behind the work is bolted to both the headstock and the tailstock, while a pitch cam is mounted on the front of the saddle for generating varying pitches on the blades by swiveling the blade as it is fed past the cutters. Rollers mounted on the cutter-arbors contact with the top and bottom of the profile cam, thus raising and lowering the cutters as they follow the edges of the blade. This cam is so designed that at the beginning and end of the cut the two cutter-heads are spread apart sufficiently to facilitate loading and unloading of the work.

Master and articulated connecting-rods for airplane engines are milled along the sides two at a time by the Milwaukee bed type Simplex milling machine shown in Fig. 8. The surfaces milled are tapered and rise on a generous curve at one end. In order to mill this changing contour accurately, the milling head is made to rise vertically in the housing of the machine as the connecting-rods are fed past the cutters.

This rising action of the spindle head is controlled by a master cam on the rear side of the





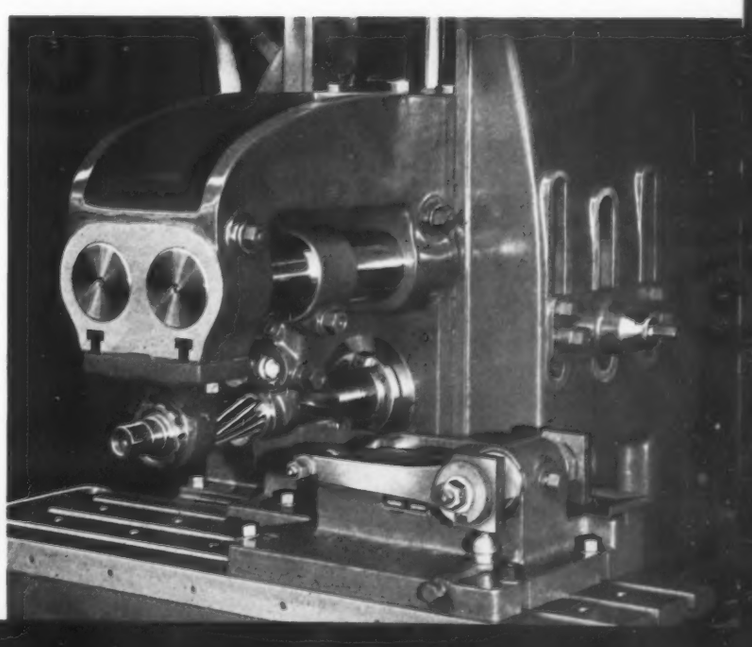


*Fig. 6. (Top) Method Employed for Grinding the Large Fillet under the Head of Tappet Valves in an Airplane Engine Plant*

*Fig. 7. (Center) Simultaneously Milling Trailing and Leading Edges of Airplane Propeller Blade to Desired Profile and Pitch*

*Fig. 8. (Bottom) Milling Operation on Connecting-rods in which the Cutter-head Rises as the Work is Fed past the Cutters*

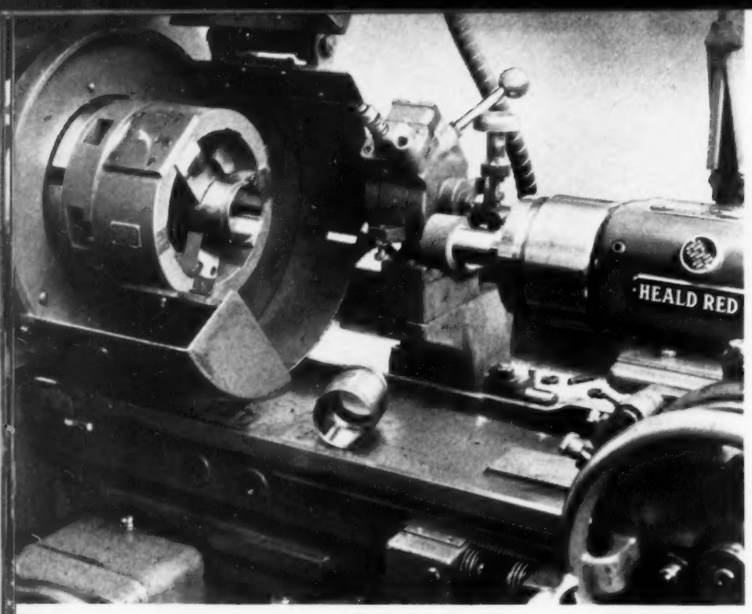



*Fig. 9. Eighteen Different Parts are Handled by This Internal Grinding Machine, which is in Operation in an Aircraft Plant*

table, which is engaged by a roller on the spindle head, in conjunction with a hydraulic cylinder and pump at the rear of the machine. The hydraulic equipment can be disconnected and the arbor support for the cutter-spindle removed when the machine is to be used for standard milling operations.

Eighteen different aircraft parts are finished by the Heald internal grinder shown in Fig. 9, which was installed in a French plant for handling a diversified range of work. Since most of the workpieces involve face-grinding, as well as internal grinding, the machine is equipped to handle both operations, there being a cross-slide under the work-head which enables quick indexing for grinding either a hole or a face. The handwheel table feed provides for plunge-cut grinding of faces, and there is a positive table stop for controlling the depth of such cuts.

# French Shops Use

The part seen in the chuck and on the machine table in Fig. 9 is a gun bracket. The operation consists of finish-grinding a 2.750-inch diameter bore and a shoulder at one end of the bore. Other typical parts ground in this machine include a distributor drive gear, magneto pinion, magneto ball-bearing housing, and generator drive gear.

Aircraft propellers are being bored in a French plant by the use of the Ex-Cell-O single-end precision boring machine shown in Fig. 10. The operation consists of boring the gun-bronze bushing by removing from 0.008 to 0.010 inch of stock on the diameter. The feed per cutter-spindle revolution is 0.002 inch, and the length of cut is 2 3/8 inches. The hourly production, based on an efficiency of 80 per cent, is twenty-five propellers. The cutter-spindle runs at 1800 R.P.M.

The angle-plate type of fixture provided on this machine is fitted with a hardened and ground ring for locating the hub end of the propeller in relation to the cutter. Strap clamps, locked by tightening hexagonal nuts, are employed to hold the propeller hub securely. The propeller blade is normally supported at its outer end by a bracket mounted on the machine table.

The tooling provided on one of a battery of Warner & Swasey turret lathes now in action in a French plant is shown in Fig. 11. The part han-



*Fig. 10. Precision-boring the Gun-bronze Bushing in the Hub End of Propellers for French Airplanes*

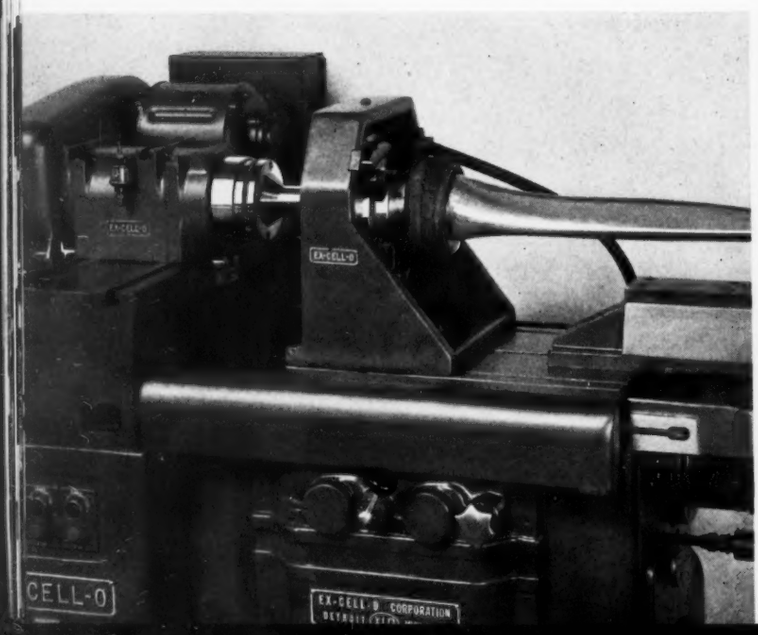
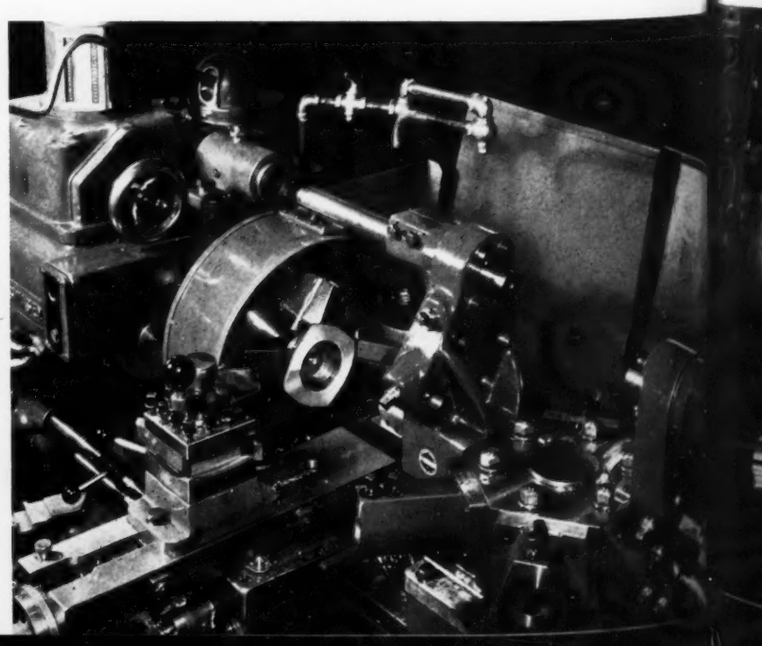



*Fig. 11. Turret Lathe Machining Generator Roller-bearing Brackets in Accordance with American Production Standards*



dled in this machine is a generator roller-bearing bracket, forged from 0.50 to 0.60 carbon steel. The illustration shows the first chucking operation on the forging after normalizing, four turret lathe chuckings being required to complete the part.

Size and concentricity are of prime importance in this operation, as well as a smooth finish on all surfaces. The part is made from a heavy forging and reduced to very thin wall sections, to obtain minimum weight and at the same time retain adequate strength.

Nitrided cylinder barrels for liquid-cooled engines are ground internally in a French plant at the rate of three barrels per hour by employing the Bryant internal chucking grinder shown in Fig. 12. These barrels are finished to the desired diameter, and straight within 0.0002 inch, from 0.005 to 0.010 inch of stock on the diameter being removed by the grinding wheel. A sizing device, equipped with a finger that rests on the surface being ground, indicates when the bore has reached the specified size.

Fay automatic lathes have been supplied by the Jones & Lamson Machine Co. to several European countries for turning and grooving airplane-engine cylinder barrels. In Fig. 13 is shown a machine of this type employed in a French plant for finish-turning and rough-grooving the cylinder barrels for a liquid-cooled engine after the barrels have been nitrided. The turning cuts are taken by a series of five tools on the front carriage as it feeds

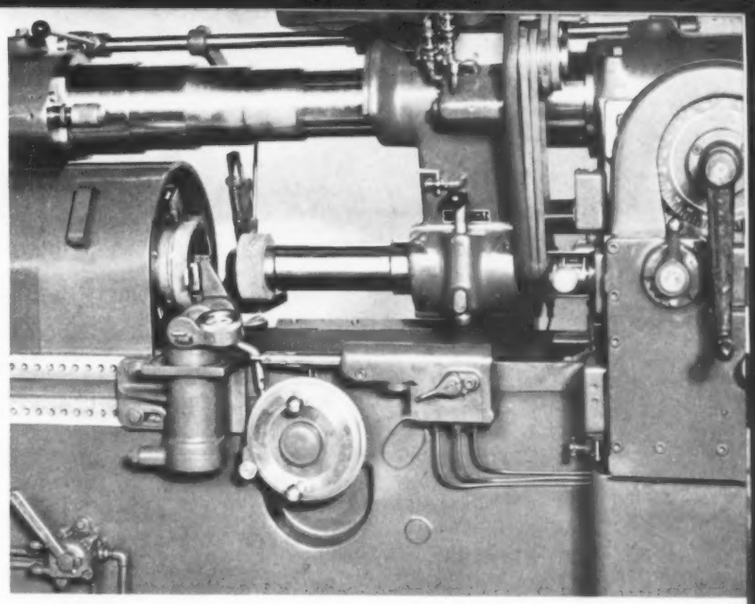


*Fig. 12. Grinding the Bore of Nitrided Cylinder Barrels for Liquid-cooled Airplane Engines by Employing a Chucking Grinder*

toward the left along the bed of the machine, and then the back arm rocks forward to bring ten other tools into contact with the work for cutting wide grooves, thus leaving narrow ridges around the circumference of the barrel.

The cylinder barrels are then passed to the Fay automatic lathe shown in Fig. 14, which is equipped with two form tools on the front carriage and three form tools on the back arm, all of which are rocked toward the work for finish-turning the wide grooves and the narrow ridges or lands. Both of the machines used in performing these operations have a swing of 20 inches.

*Fig. 13. Tooling Employed on a Fay Automatic Lathe for Turning and Rough-grooving Nitrided Cylinder Barrels*

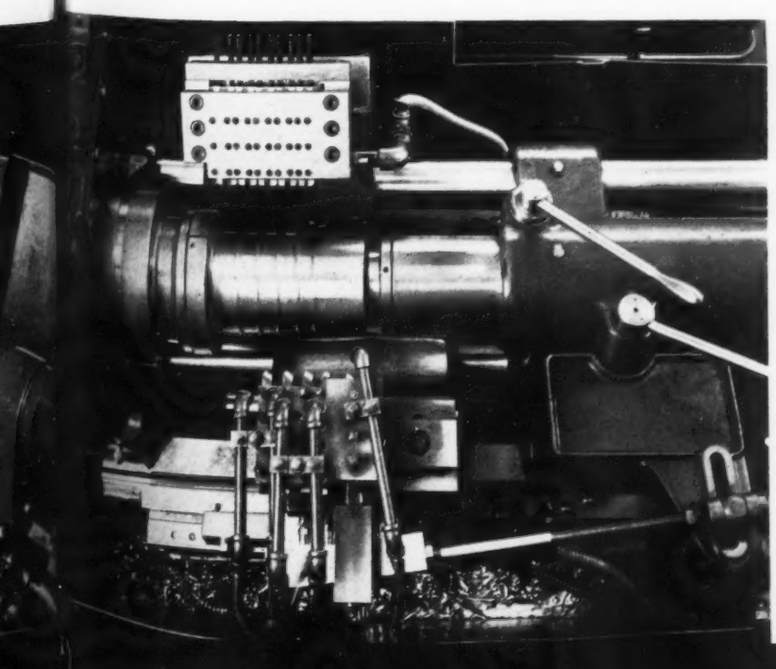
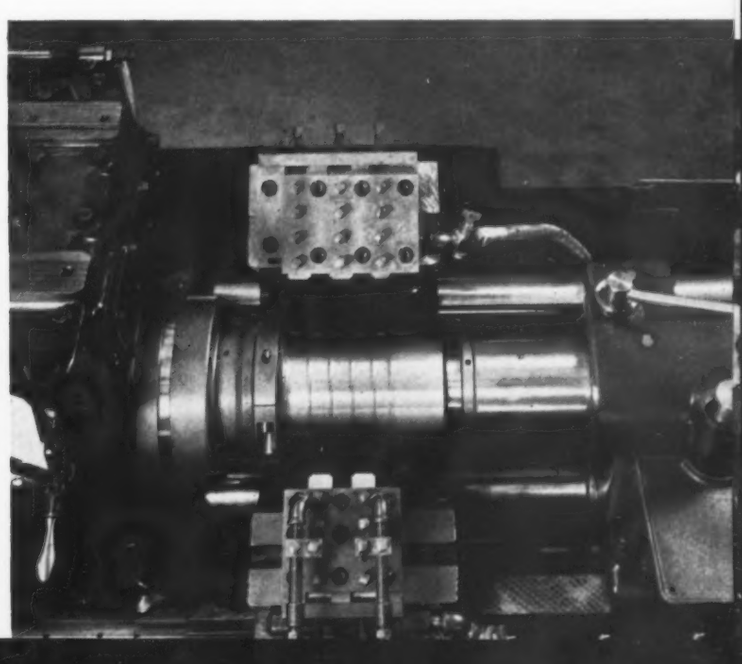


*Fig. 14. Another Fay Automatic, which Finish-turns the Grooves and Lands on Cylinder Barrels after the Operation Shown in Fig. 13*



# Selling Machine Tools

SOUTH America, today, offers exceptional opportunities to American builders of machine tools and other metal-working equipment for the expansion of their foreign markets. In considering the possibilities of winning permanent machine tool markets in the countries of our neighboring continent, however, some of the peculiar problems involved under normal world conditions should be recognized. Most of these problems have been eliminated temporarily, because South American countries, at present, are as anxious as other foreign countries to obtain American metal-working machines.

Under more normal conditions, for example, South American purchasers usually demand a credit of ninety days and at times considerably longer, whereas an extension of credit is not generally required in selling to European buyers. Long credit terms have always been granted to South American concerns by European competitors, and to remain in this market, American manufacturers or exporters have had to meet the same terms.

As many of the purchasers of machine tools in South American countries are government departments, quotations must be made in the currency of the country involved, which brings certain exchange risks, especially as most of the purchases are made by public tender. This requires that prices be maintained for much longer periods than is the case in making similar sales in this country.

Slowness in closing business deals is a characteristic of the average South American buyer, which means that when a decision is finally made, prices and deliveries cannot always be maintained; and it is difficult to get a purchaser, especially a representative of the government, to accept new figures when prices have risen during the delay.

Another handicap to the American representative in South America is that not many machine tool builders supply literature or specifications in Spanish or Portuguese, with the result that machine specifications must be translated by their representatives. This is far from simple, due to the fact that neither the Spanish nor the Portuguese language is very rich in technical terms.

It is essential that the American representative of machine tool builders learn the language and adopt the general business practice of the country in which he is located. Quality and price are important factors in doing business in any country, but in order to sell successfully, the salesman in South America must gain the friendship and confidence of his customers to a greater extent than in other countries, and must possess unusual patience.

It has been quite common practice in the past for bids to be called four or five times in as many years before a purchase is finally made. Furthermore, on account of the high cost of American machine tools, as compared with European machines, more "missionary" work has been necessary in order to have requests for bids based on



*Fig. 1. Cincinnati Milling Machine in the Brazilian Marine Arsenal*

*Fig. 2. Buffalo Single-end Machine for Cutting Sprues from Castings*

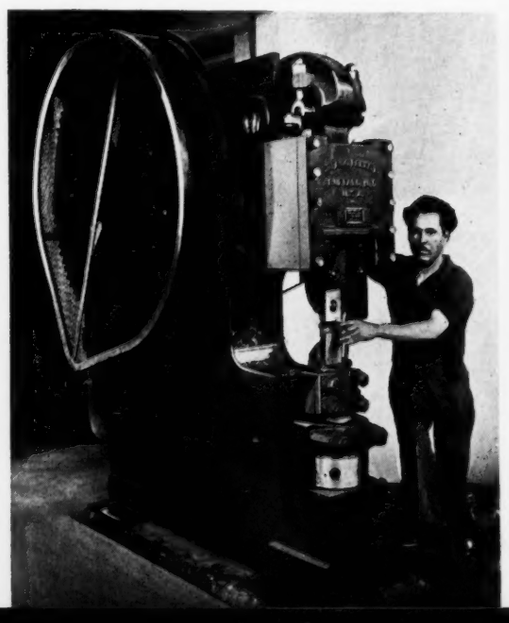
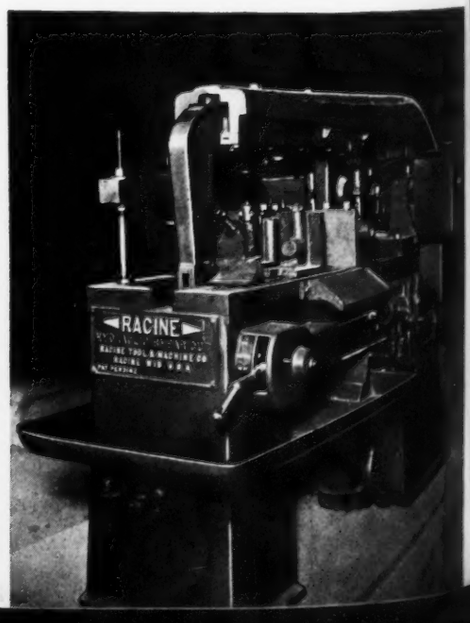


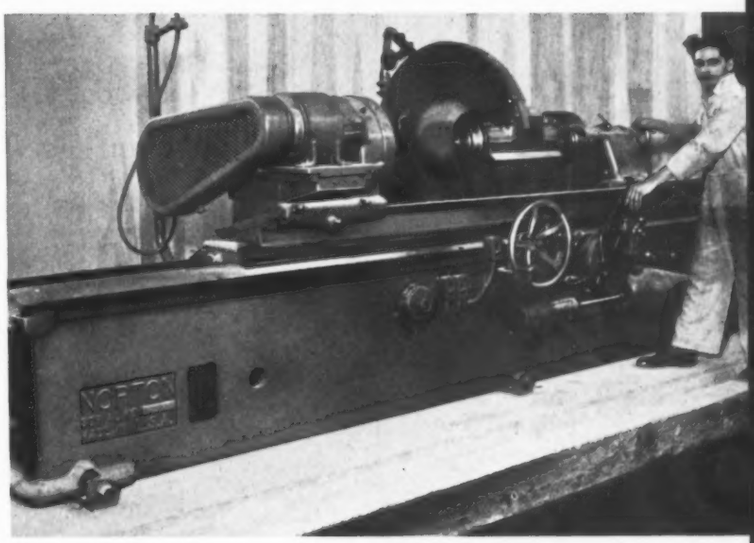
*Fig. 3. Racine 12-inch by 12-inch Hydraulic Hacksaw*

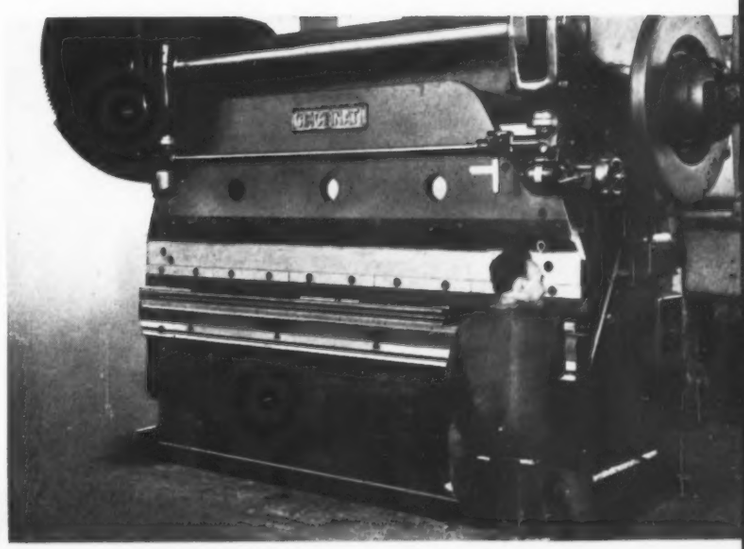


# in South America

*By H. K. SMYTH*
*Sales Representative*
*Niles-Bement-Pond Co.*
*Rio de Janeiro, Brazil*

*Fig. 4. (Right) Norton Crankshaft Grinding Machine. Fig. 5. (Center) Cincinnati Eight-foot All-steel Press Brake*



American specifications and insure the appropriation of sufficient money to cover the bids.

South America is a fertile field for American metal-working machinery, but our success in establishing a permanent market there depends largely on the efforts of our machine builders.

The illustrations (with the exception of Fig. 8) show a number of machines sold through the Niles-Bement-Pond Co. to the Brazilian Government and installed in a new Marine Arsenal established on an island in the harbor of Rio de Janeiro. The work to be carried on in this Arsenal will consist of maintaining and repairing naval vessels, and constructing new vessels. The existing navy comprises two battleships, two light cruisers, and a number of destroyers, submarines, and auxiliary craft. Four destroyers of American design are under construction, and half a dozen smaller ships.

In the construction of new ships, all work is being done at the Arsenal, from the laying of the keel to the completed vessel, except the making of the engines, boilers, and armament. These units are purchased abroad. The new Arsenal is not yet in full operation and many of the buildings are still without machinery and tools, but these are being gradually purchased. The machine shown in Fig. 8 is installed in a Brazilian railroad shop.



*Fig. 6. Cincinnati Heavy-duty Rapid Traverse Shaper*

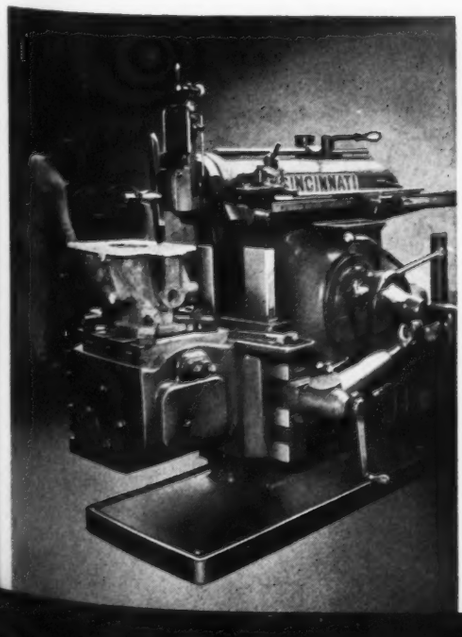


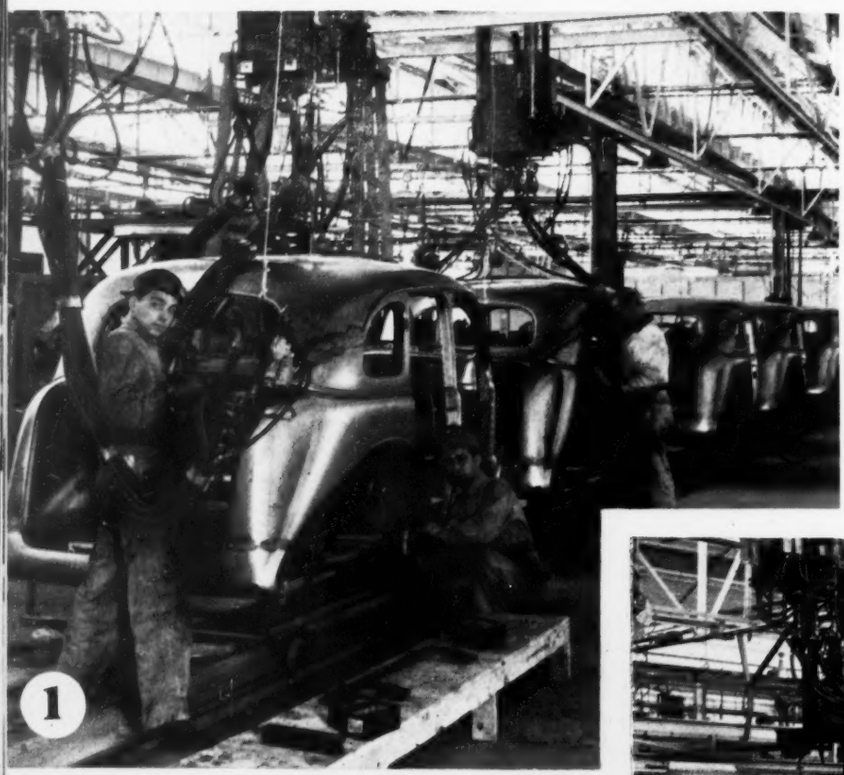

*Fig. 7. Natco Multiple-spindle Drilling Machine*

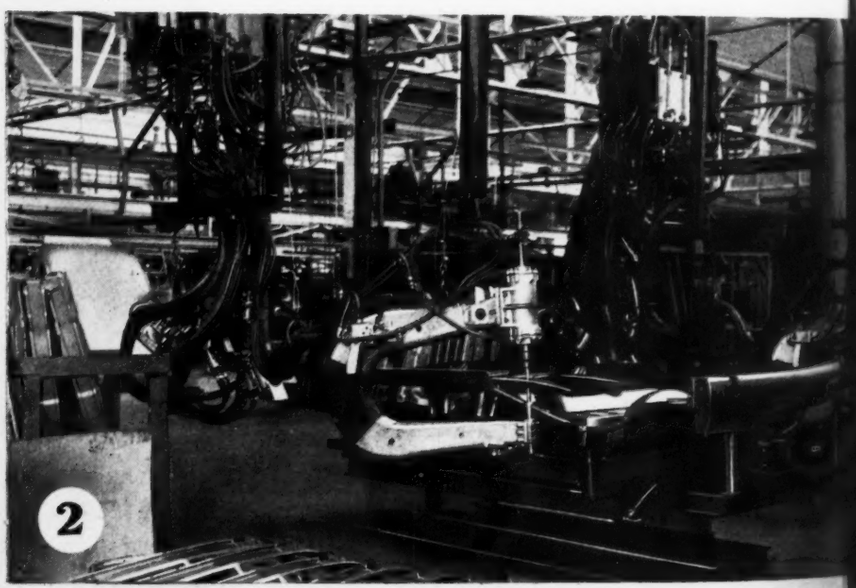
*Fig. 8. Niles 33- by 44-inch Boring Mill with Side-head*

# Overseas Everywhere

*The Sun Never Sets on the Manufacturing and Assembly Plants of the General Motors Overseas Operations.*

Fig. 1. Welding Operations along the Body Line in the Mexico City Plant of General Motors de Mexico S. A. de C. V. are Performed with Modern American-built Equipment. Fig. 2. Fisher Body Welding Unit with Clark, Square D, and Electrical Controller Timers and Switches in Use in the Buenos Aires Plant of General Motors Argentina S. A. Fig. 3. Thor Portable Electric Polishers and Balancers Expedite Operations along the Body Line of General Motors South African Ltd. Fig. 4. Long Line of Heavy Clearing Presses (at Left) Installed in the Luton, England, Plant of Vauxhall Motors Ltd.

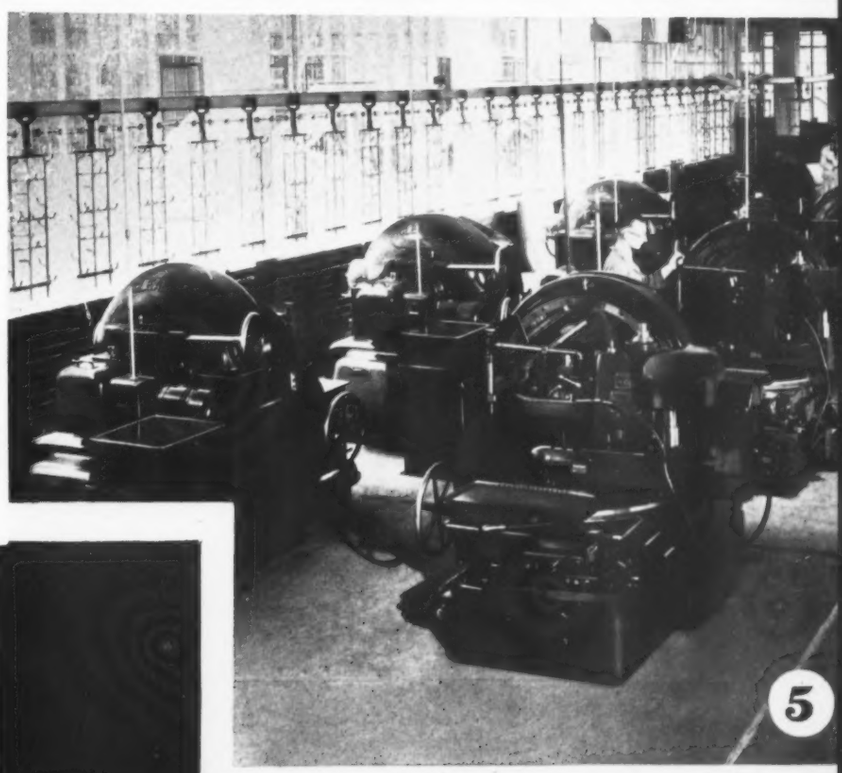


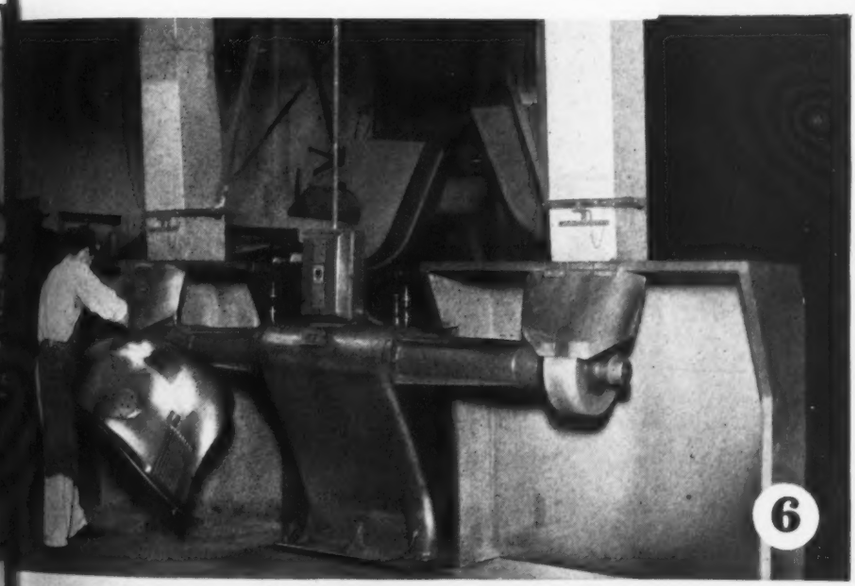



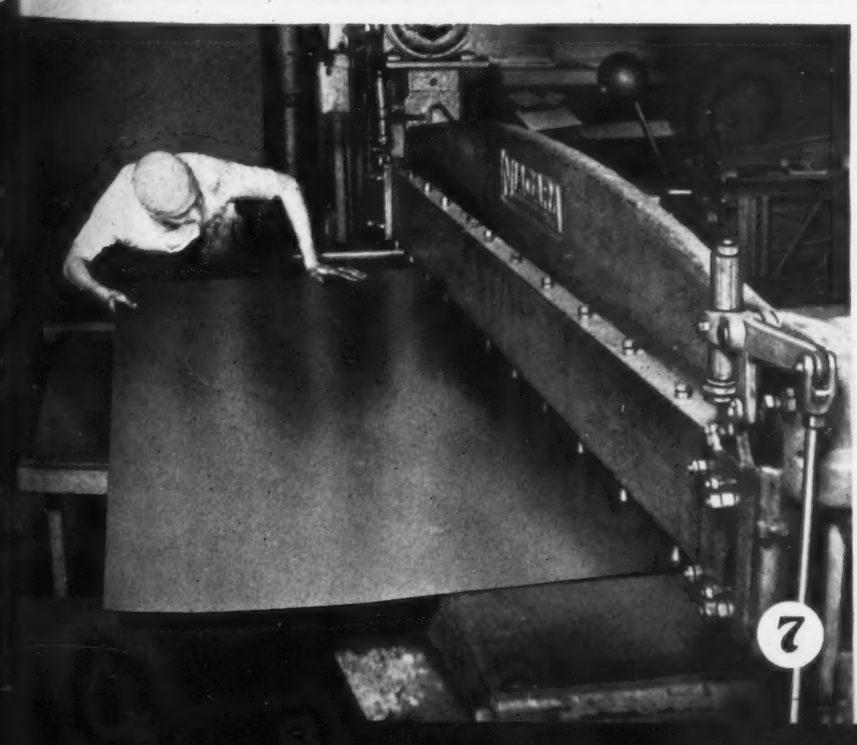
# with General Motors

*They are Found in Central and South America, Europe, Africa, China, Japan, Australia, and Even Java*

Fig. 5. One of Several Batteries of Gleason Gear-cutting Machines that have been Placed in Operation at Vauxhall Motors Ltd., Luton, England. Fig. 6. Buffing Automobile Fenders in the Argentine Plant on a Machine of Modern Design Built by the United States Electrical Tool Co. Fig. 7. Using a Niagara Sheet-metal Shear in the Plant of General Motors do Brasil S. A., which is Located at Sao Paulo, Brazil. Fig. 8. Smoothing an Automobile Body with a Black & Decker Portable Electric Sander in the Plant of General Motors South African Ltd., which is Located at the Southern Tip of Africa.



# Overseas Everywhere

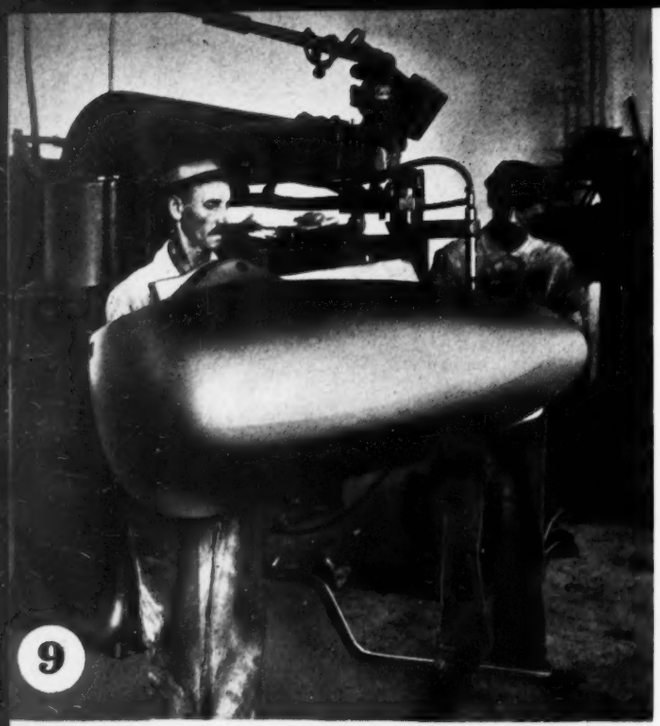
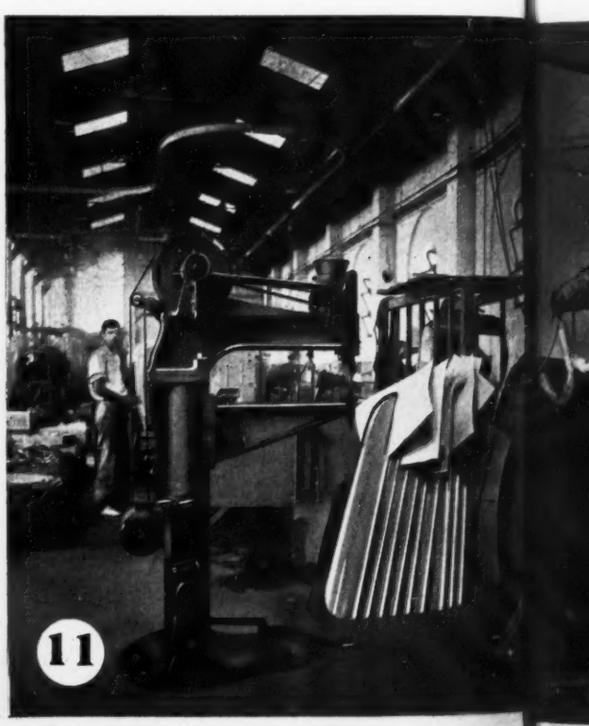
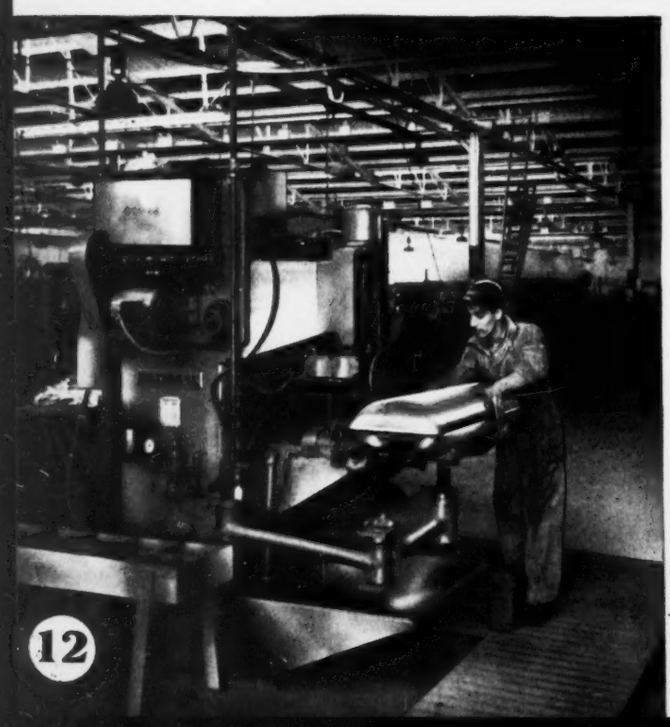
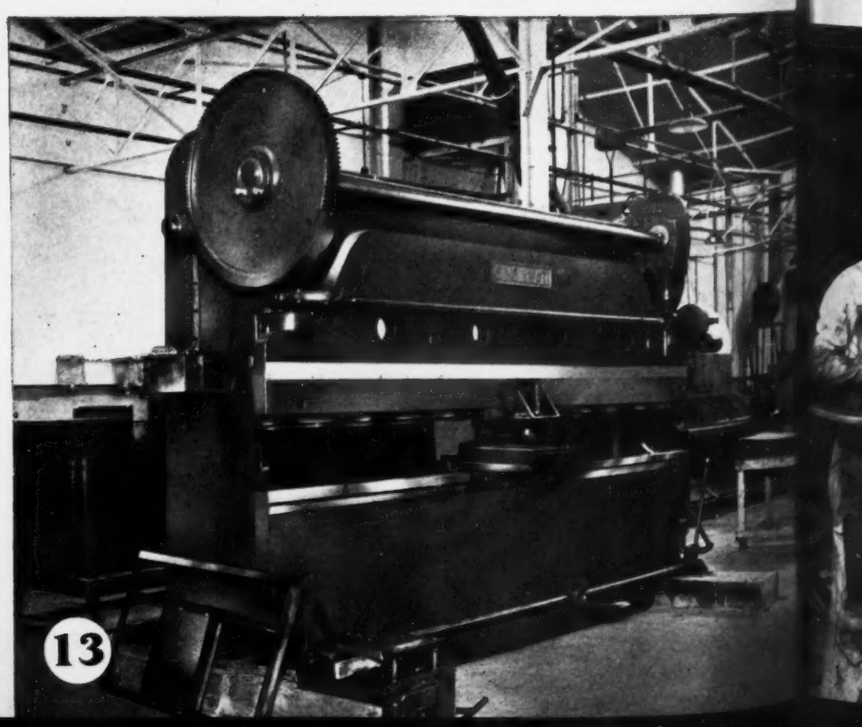



Fig. 9. Welding an Automobile Fender in the Plant of General Motors South African Ltd. by Employing a Welding Machine Built by the Federal Machine & Welder Co. Fig. 10. Battery of Gleason No. 11 Single-cycle Formate Ring Gear Cutting Machines at Vauxhall Motors Ltd. in England. Fig. 11. Automatic Rivet Setting Machine Built by the Chicago Rivet & Machine Co. and Installed in the Alexandria Plant of General Motors Near East S. A. Fig. 12. Seam-welding Gasoline Tanks in the Mexico City Plant by Employing a Resistance Welding Machine Built by the National Electric Welding Machines Co. Fig. 13. Cincinnati Press Brake which is in Constant Operation Forming Long Pieces of Sheet Metal in the Buenos Aires Plant of General Motors Argentina S. A.

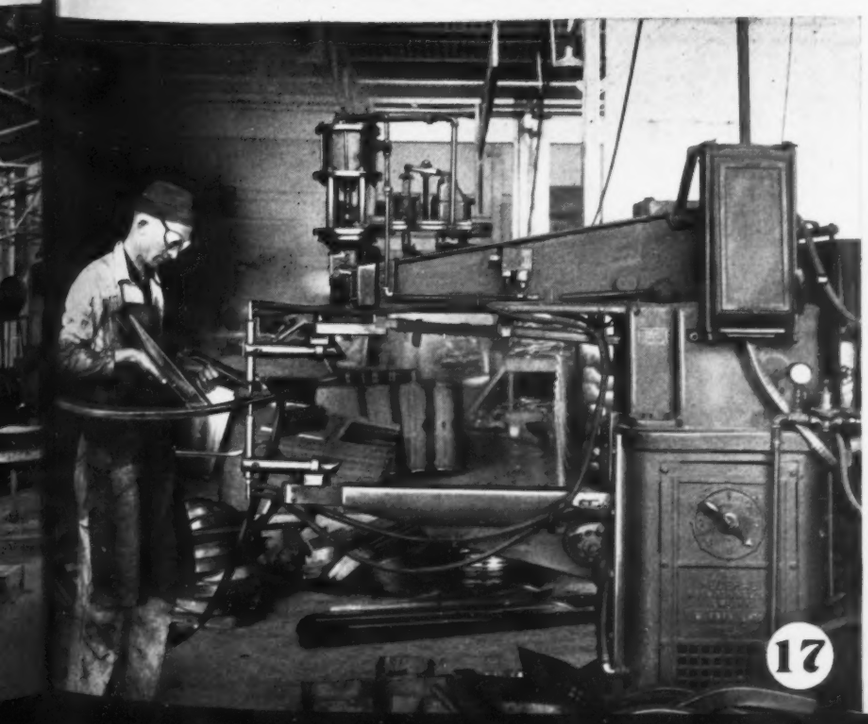


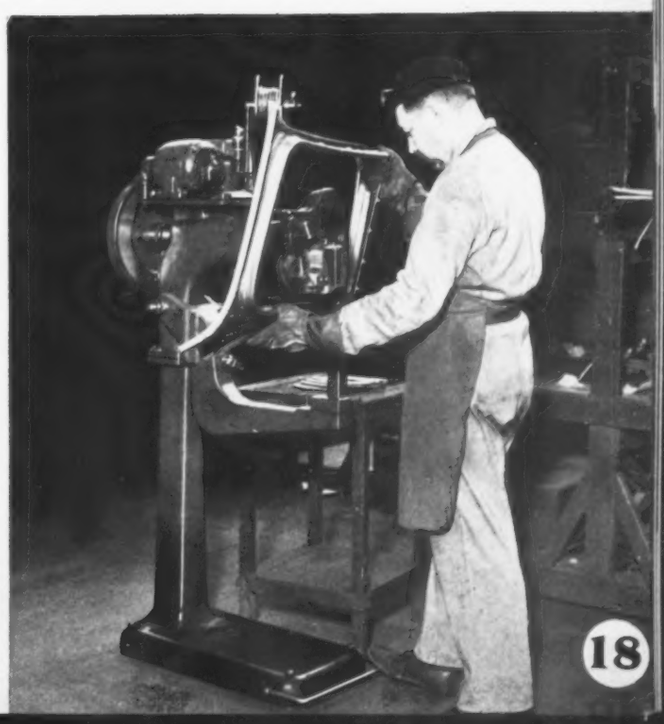



# with General Motors

Fig. 14. Assembling Automobile Frames with a Hannifin Hydraulic Riveter in the Sao Paulo Plant of General Motors do Brasil S. A., which is General Practice in General Motors Overseas Plants. Fig. 15. The Handling of Cab Bodies along an Argentine Assembly Line is Facilitated by the Use of a Shepard Niles Hoist. Fig. 16. Hannifin Hydraulic Riveters are also Used in Chassis Construction in the General Motors Plant Located at the Southern Tip of Africa. Fig. 17. Federal Welding Machine Engaged in Welding Sheet-metal Sections in the Body Shop of the South African Plant. Fig. 18. Metal Stitching Machines are Used in General Motors Plants the World Over. The Morrison Stitching Machine Here Shown is Installed in the Argentine Plant.



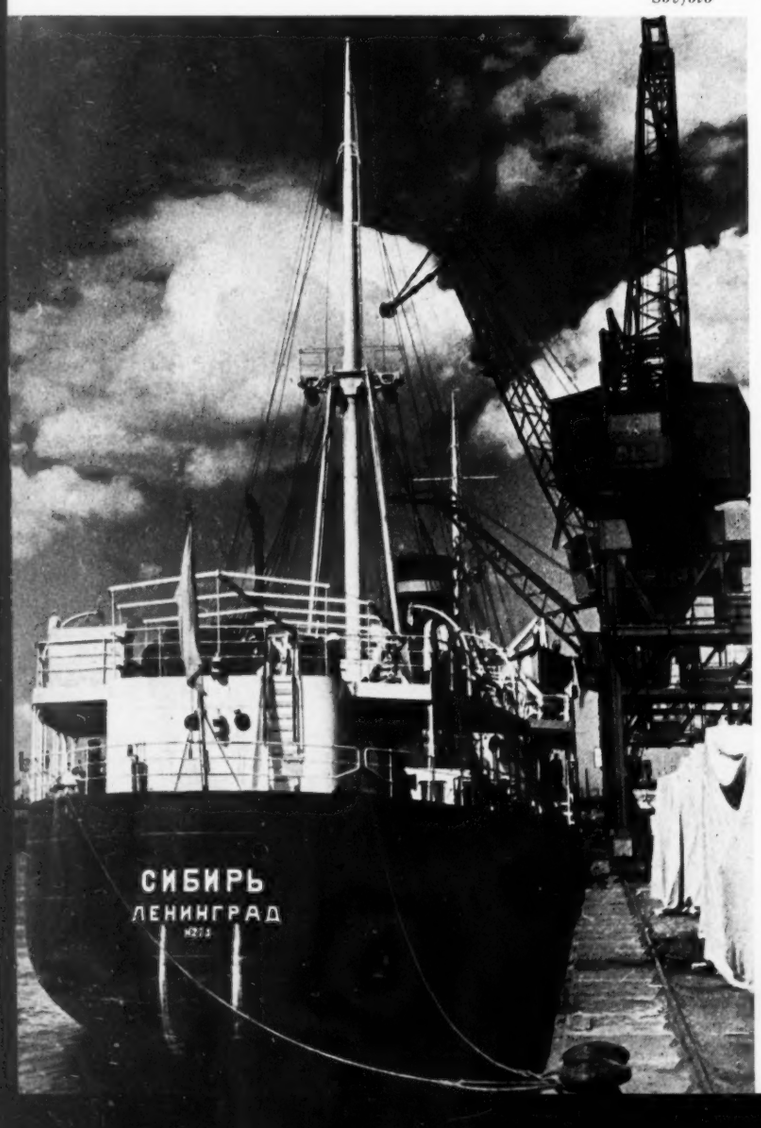
# Russian Methods Developed

WHEN the Union of Soviet Socialist Republics started out on its original five-year program of industrial development, the metal-working shops of the United States were selected as a pattern, because of the world-acknowledged superiority of our manufacturing methods. Delegations of Russian engineers came to the United States to study our practices and many American engineers went to the Soviet Union to supervise the construction and equipping of industrial plants.

Huge orders were soon placed by the Soviet Union for American-built machine tools and other metal-working equipment, with the result that from 1922 to 1930 Russia became our most important customer, the total purchases of metal-working machinery by that country in 1930 reaching $14,187,251. Our second best customer that year purchased less than $7,000,000 worth of machinery of this kind. In 1931, Russia was again high, the metal-working equipment purchased amounting to almost $22,500,000. In the following years Russian purchases of this class of machinery dropped materially, but in 1936, they reached a total of $15,382,516, and in 1938, they represented the greatest amount of business ever placed with any one country, so far as metal-working machinery is concerned—a total of $34,690,305.

In 1939, the sale of metal-working machinery to Russia fell off considerably as a result of the war and the trade agreements concluded with Germany. However, it is estimated that it amounted to $18,000,000, which would make Russia rank fourth among the nations of the world. A considerable number of the American-built machines sent to Russian shops during the last few years are illustrated in this article tooled for high production and accuracy, according to American practice.

*Sovfoto*




Rifle barrels are ground on irregularly curved surfaces near the breech end in a Russian arms plant, as shown in Fig. 1. The machine used is a standard Thompson hydraulic surface grinder equipped with a special control for the operating cycle of the table and a hydraulic device for form-truing the grinding wheel. The curved surfaces are ground within a tolerance of 0.001 inch at a net production rate of sixty barrels an hour.

Twelve barrels are loaded in the fixture at one time and fed past the grinding wheel by the automatic operation of the machine table. The wheel is fed downward automatically in a plunge cut to a sizing stop. Automatic truing compensates for wear of the grinding wheel and controls the size of the work.

Eighteen surfaces are ground with one chucking of the work in the operation illustrated in Fig. 2, which is being performed on a Brown & Sharpe No. 2 surface grinding machine. The operation consists of grinding two flat surfaces and four bevel surfaces on each of three arms or lugs that project radially from the work. The work is indexed for grinding either a flat or a bevel surface on one of the arms, and the same surface is then ground on the other two arms before the next surface is ground on the first arm. A straight surface is ground first on all arms, then two angular surfaces, next the second straight surface, and finally, the third and fourth angular surfaces.

The accuracy of the finished surfaces is determined by means of two dial indicators, one of which checks the straight surfaces and the other the angular surfaces.

A multiple-spindle semi-automatic machine of unusual design supplied by the Foote-Burt Co., Cleveland, Ohio, to a Russian plant for drilling, counterboring, and tapping sixteen counterweight screw-holes in tractor crankshafts is illustrated in Fig. 3. This machine is equipped with three multiple-spindle hydraulically operated heads and one tapping head actuated by a lead-screw. Six cycles of the machine are required to complete the operation on one crankshaft, the machine table being indexed crosswise between each cycle in order to bring the four cranks successively into line with all the heads.

In the first indexed position of the table and fixture, four holes are drilled in the No. 1 crank by means of the multiple-spindle head at the front right of the machine. The work is then turned through 180 degrees on its fixture, and the table is indexed through one space to bring the work into the second position, where four holes are drilled in the No. 2 crank by the front right head, and at the same time the holes previously drilled in the No. 1 crank are counterbored by the tools on the front left head.

After the fixture has been indexed into the third position, four holes are drilled in the No. 3 crank with the front right head. The four holes in the No. 2 crank are counterbored with the rear right head and the four holes in the No. 1 crank are tapped with the rear left head. The crankshaft is then again revolved through 180 degrees and the fixture indexed into the fourth position. Here four holes are driilled in the No. 4 crank with the front right head, the four holes in the No. 3 crank are counterbored with the front left head and the four holes in the No. 2 crank are tapped with the rear left head.

The fixture is then indexed to the fifth position for counterboring the four holes in the No. 4 crank with the rear right head and tapping the four holes in the No. 3 crank with the rear left head. Again the crankshaft is indexed through 180 degrees and the fixture indexed to bring it into the sixth position for tapping the four holes in the

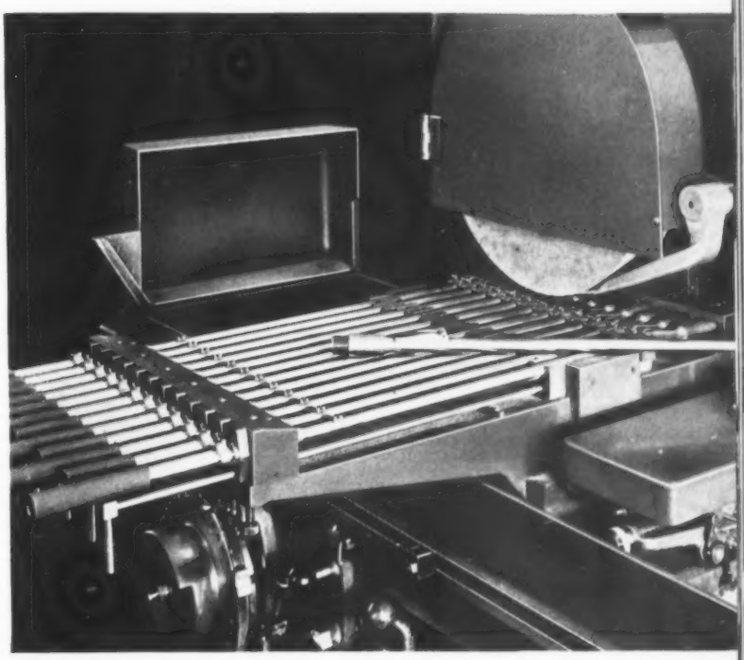


*Fig. 1. Grinding Curved Surfaces on Twelve Rifle Barrels in One Operation at a Production Rate of Sixty Barrels an Hour*

*Fig. 2. An Operation in a Russian Plant on a Brown & Sharpe Surface Grinding Machine, in which Eighteen Surfaces are Ground with One Chucking of the Work*

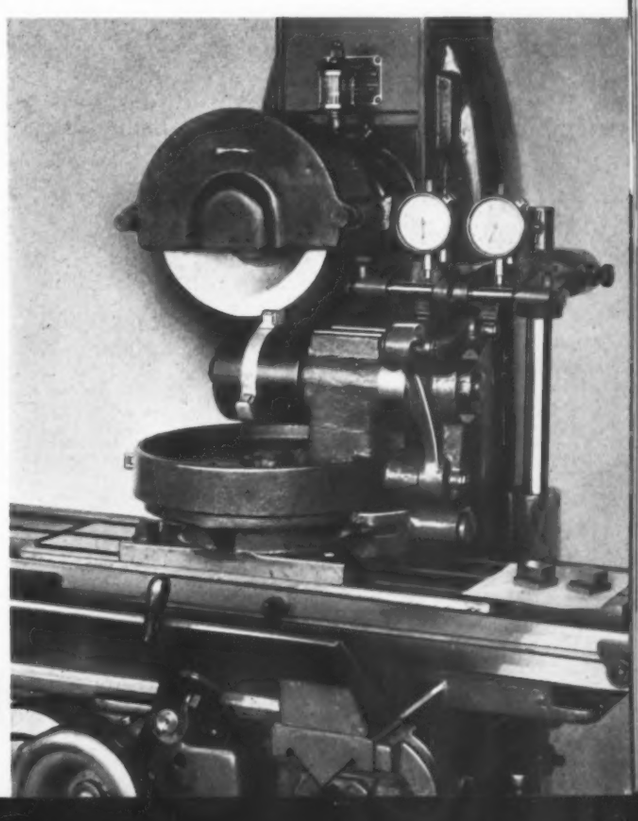


*Fig. 3. Machine Used for Drilling, Counterboring, and Tapping Sixteen Counterweight Screw-holes in Crankshafts for Tractor Engines*

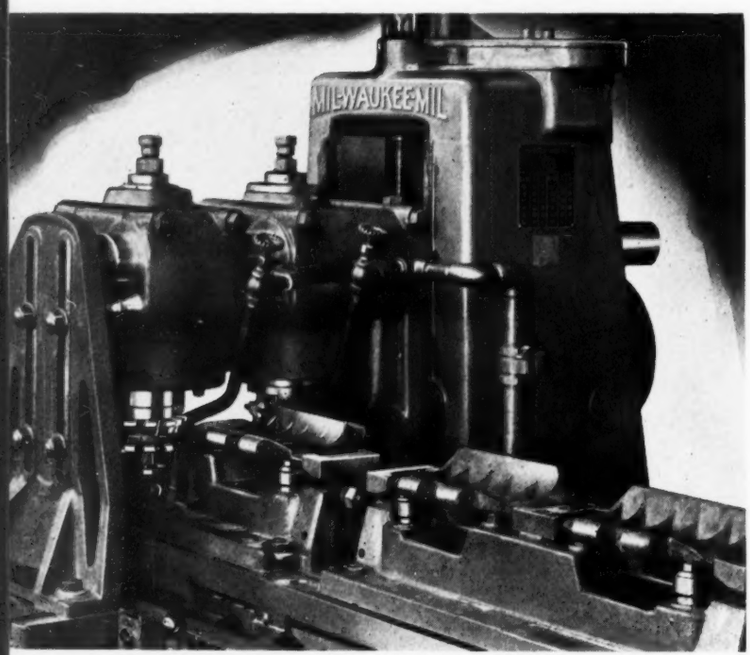



*Fig. 4. Two-spindle Milling Machine Equipped with Form Cutters for Taking Simultaneous Cuts on Opposite Sides of Steel Forgings*

No. 4 crank with the rear left head. Eight or nine crankshafts are produced per hour.

Form cutters on the two-spindle Mil-Waukee-Mil Simplex milling machine shown in Fig. 4 mill small-diameter cylindrical surfaces on the opposite sides of steel forgings simultaneously as the table of the machine feeds along beneath the cutters. Each forging has four of these cylindrical surfaces, two on each side.

The two-spindle vertical attachment is driven from the main spindle nose through a gear. The spindle heads can be removed when a standard machine is desired for any type of milling operation within its range. The outer spindle can be adjusted vertically.

A huge extrusion press designed for the production of duralumin airplane parts is shown in Fig. 5. This press, which has a capacity of 4500 tons and handles billets up to 24 inches in diameter by 36 inches in length, was built by the Baldwin-Southwark Corporation. It has a working stroke of 7 feet and a ram 59 inches in diameter.

The press is operated by two hydraulic pumps which deliver 200 gallons per minute at a pressure of 3200 pounds per square inch. Two motor-driven coarse-tooth saws are provided for cutting-off operations. The machine alone weighs over a million pounds, and the auxiliary equipment about 500,000 pounds.

Connecting-rods and caps are being ground on their joint faces at the rate of 550 rods and 550 caps per hour by the Blanchard automatic surface grinding machine illustrated in Fig. 6, which is in operation in an automobile plant. This machine is equipped with two grinding heads, one for rough-grinding the parts as they are carried beneath it, and the other for finish-grinding them as they return toward the front of the machine. Each head is equipped with an automatic control

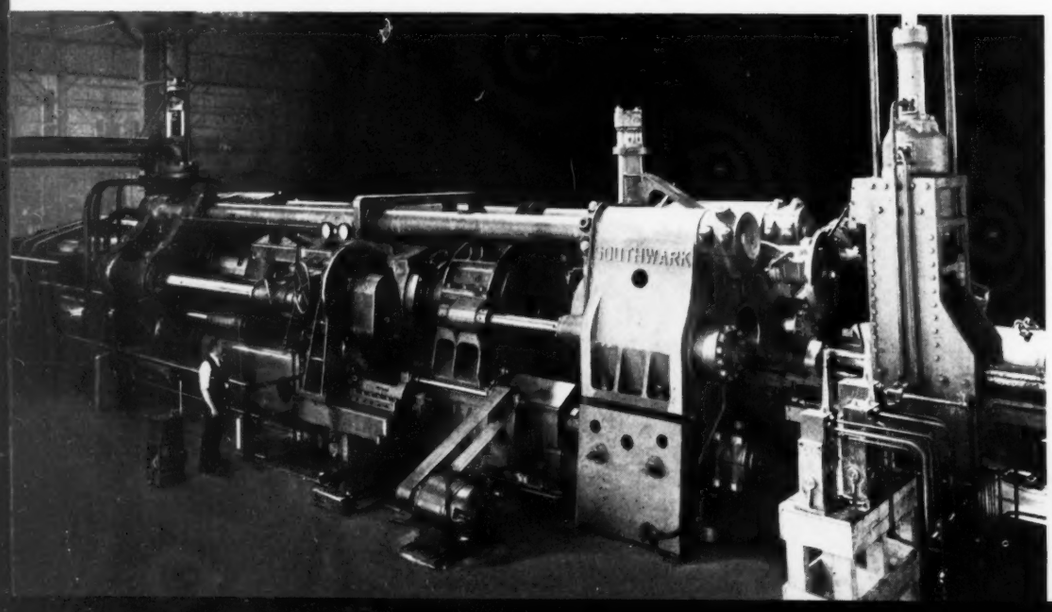



*Fig. 5. Extrusion Press of 4500 Tons Capacity which Handles Billets 24 Inches in Diameter by 36 Inches Long*

that insures grinding the parts to a definite size. The roughing wheel generally removes from 0.015 to 0.020 inch of stock, leaving 0.005 inch of stock to be removed by the finishing wheel.

The size of both the connecting-rods and caps is held within plus or minus 0.001 inch; and because the finishing wheel is required to remove only a small and a uniform amount of stock, an unusually smooth finish is attained. The surfaces ground show 90 per cent bearing, or better, when tested on a surface plate.

Wooden dies are used exclusively on the press shown in Fig. 7 for forming sheet-metal airplane parts. This press is one of six double-acting forming presses of 665 tons capacity, supplied to a Russian plant by the Lake Erie Engineering Corporation. The illustration shows, in the wooden die, a pontoon formed by the wooden punch that can be seen above the blank-holder. The blank-holder is attached to the lower ends of pins which extend down through the moving platen from the overhead platen. This press operates at approach and return ram speeds of 200 inches a minute.

Four holes are drilled simultaneously the full length of camshafts for a straight-in-line airplane engine on the four-spindle deep-hole drilling machine illustrated in Fig. 8, which was built by the W. F. & John Barnes Co. Each of the four spindles is equipped with a chuck for holding a camshaft, and steadyrests are provided for supporting the outboard end of the camshafts, so as to eliminate deflection during the drilling operation.

A hydraulic unit on the bed of the machine provides power for operating the carriage on which the camshafts are mounted, a maximum stroke of 72 inches being available through the hydraulic cylinder within the bed. The deep-hole drills employed are similar to standard rifle drills, consisting of two-fluted drill tips on hollow shanks

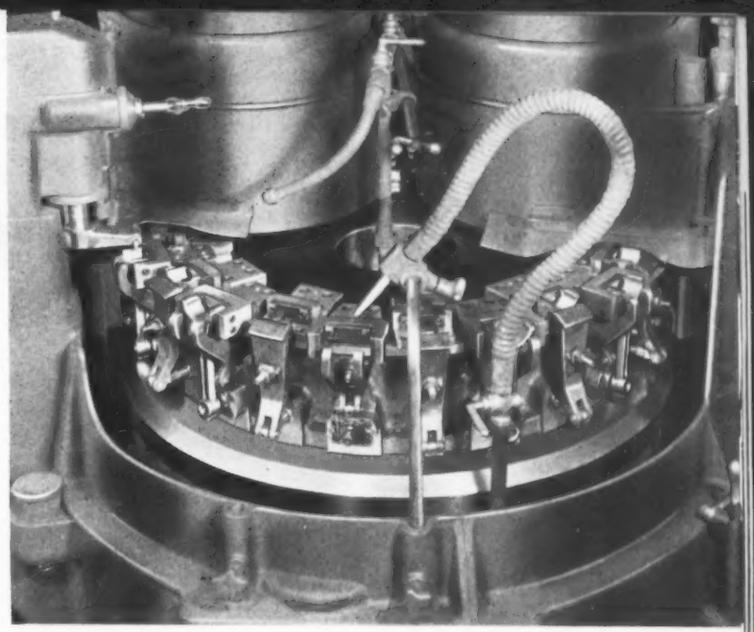


*Fig. 6. Rough- and Finish-grinding the Joint Faces of Connecting-rods and Their Caps at the Rate of 550 Rods and 550 Caps per Hour*

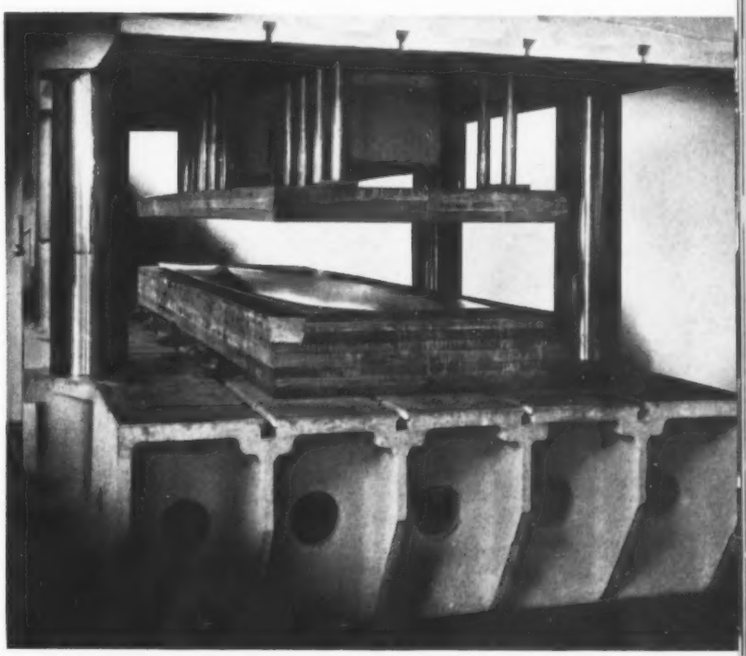


*Fig. 7. Using Wooden Dies in a Russian Plant for the Forming of Airplane Parts from Sheet Aluminum*

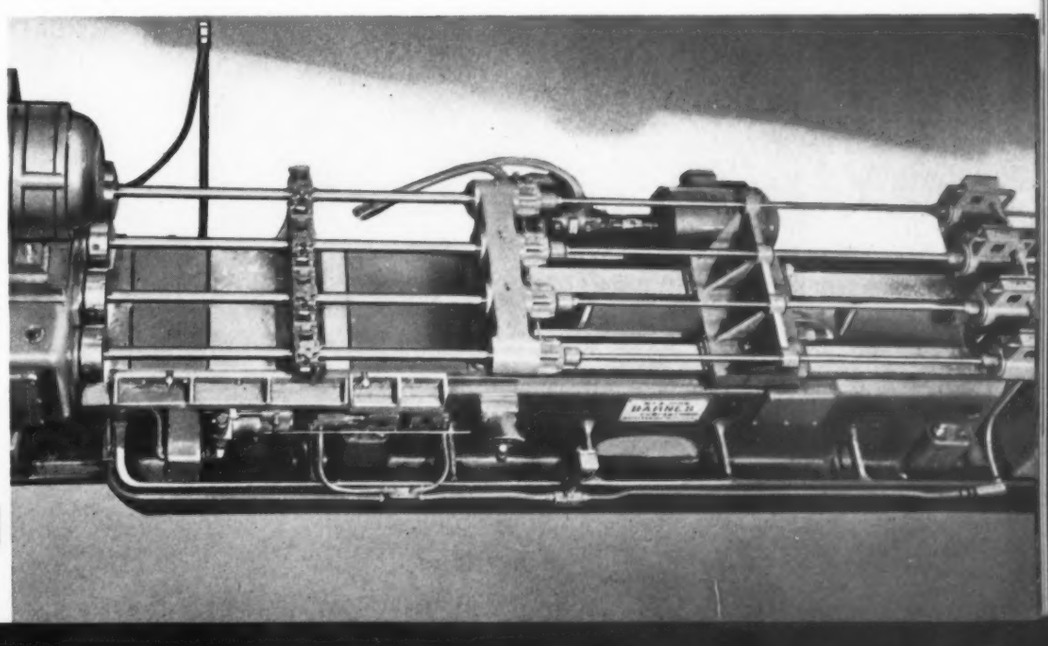


*Fig. 8. Drilling Camshafts 65 Inches in Length, Four at a Time, in a Russian Airplane Plant*

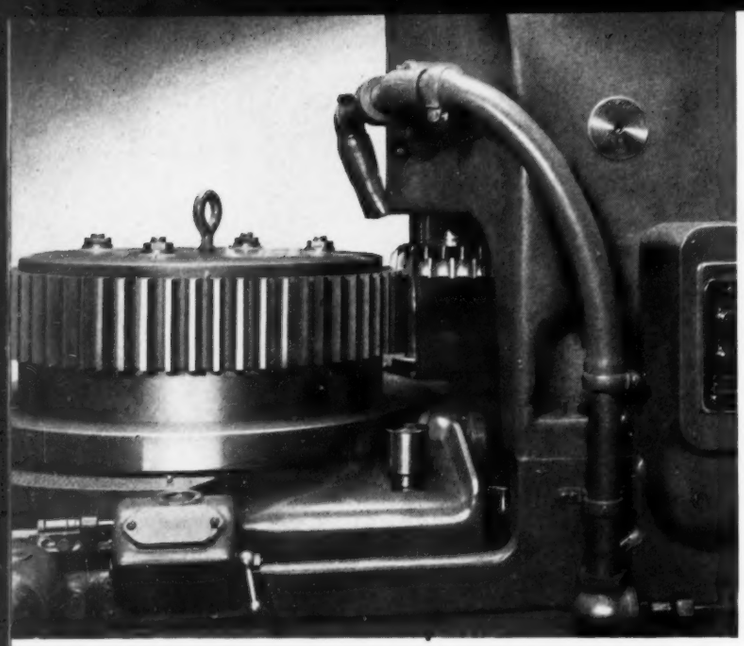


*Fig. 9. Cutting a Large Bull Gear for Tractors in a Fellows Gear Shaper Having Capacity for Gears up to 40 Inches Pitch Diameter*

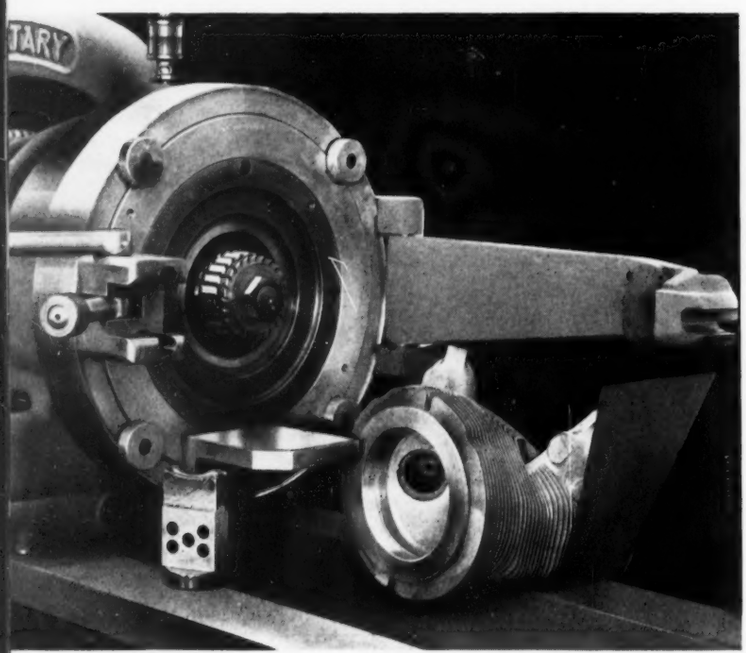
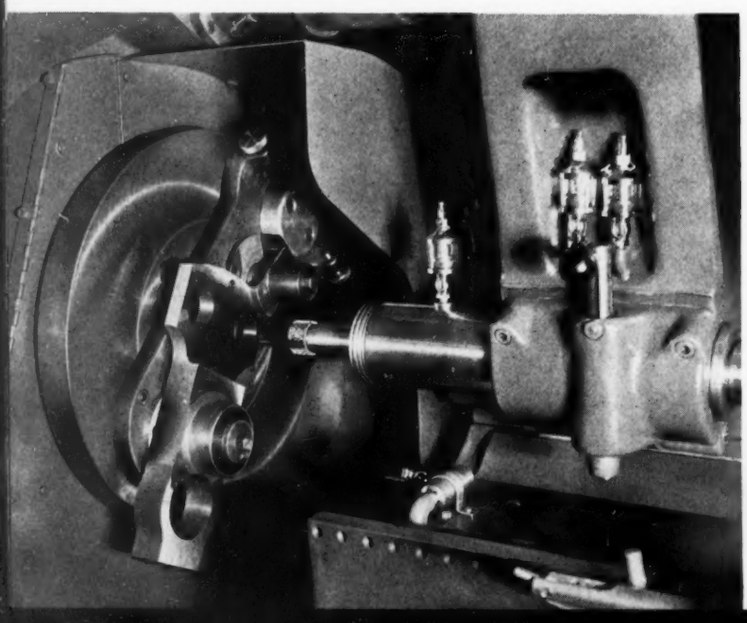


*Fig. 10. (Above) Milling Threads and a Plain Cylindrical Surface in Airplane Engine Cylinder Heads. Fig. 11. (Below) Grinding Two Holes in Crank-arms*



through which coolant passes to the tips. The drills are held in sleeves mounted in the tailstock.

Four camshafts are completely drilled per hour in this machine. The concentricity in the hole from end to end of camshafts 65 inches long is held within 0.003 inch.

Large bull gears for Russian tractors are being cut on the Fellows 30 type gear shaper illustrated in Fig. 9, which has capacity for gears up to 40 inches in diameter by 8 inches face width and 2 diametral pitch. The gear shown being cut in the illustration was about 28 inches in diameter. The work-table of this machine is provided with a fast traverse for moving the work rapidly toward and away from the cutter, and for approximately positioning the work in relation to the cutter.

A feed-cam is employed for the depth feed, which operates independently of the lead-screw used for the rapid traverse. The feed-cam controls the depth of cut per stroke of the cutter through change-gears. Upon the completion of a gear, an air cylinder returns the work-table to the starting position.

Cylinder heads for airplane engines have the large bore milled and threaded simultaneously in the Hall Planetary machine illustrated in Fig. 10. Both the threads and the bore must be machined within close limits of accuracy, the over-all tolerance on the pitch diameter of the threads being only 0.001 inch. The bore must be finished within the same tolerance in relation to the pitch diameter of the threads.

From the illustration it will be observed that the thread milling cutter and the bore finishing cutter are made integral. The cylinder head is located from an external surface turned around the face, which is seated in a locating ring in the head of the machine. A swinging clamp holds the cylinder head rigidly to the locating ring when the milling cutter automatically moves off center to cut the threads and the bore surface to the proper depth and then makes its planetary movement around the inside of the work. The threads and bore are milled in one revolution of the cutter.

One of the crank-arms for a built-up crankshaft used in airplane engines is shown in Fig. 11 in a machine employed for grinding two holes. The machine is a Bryant internal chucking grinder. It finishes the hole to size within plus or minus 0.0005 inch while removing from 0.015 to 0.020 inch of stock on the diameter. The fixture enables the

crank-arm to be indexed for grinding the two holes in one chucking. Fifteen holes can be ground per hour, on the average.

The same machine equipped with a different fixture is employed for grinding the larger hole at the opposite end of the crank-arm.

The shoulder and flange face on one end of the cylinder heads for radial airplane engines are both ground by one wheel in the operation shown in Fig. 12. This operation is being performed on a Landis Type C universal grinding machine. The grinding wheel is beveled, so that when it is fed toward the work, one side of the beveled face feeds down along the flange face to grind it to size, and finally, the other surface of the beveled wheel face comes into contact with the cylinder-head shoulder and grinds it circumferentially.

The grinding machine is of standard construction, except for the headstock and the provision for swinging work up to 20 inches in diameter. The wheel-base is positioned at an angle, as required for the operation. The machine was provided with an exceptionally rugged live-spindle headstock because of the size and weight of the cylinder heads, which must be carried without any outer support. The cylinder head is mounted on a hydraulically operated expanding arbor which is provided with means for locating in a lateral direction.

Cylinder barrels for liquid-cooled airplane engines are semi-finish-turned, finish-turned, and finned in a Russian plant by a battery of 20-inch Fay automatic lathes; the fin-turning machine is illustrated in Fig. 13. Three banks of thirty-four tools each are used at the front, top, and rear of the machine for cutting deep grooves to form the narrow fins.

The forging is supported internally by an air-operated expanding arbor which extends from the headstock, and by a second arbor on the footstock.

Threads are being ground on an aircraft propeller shaft by means of the Ex-Cell-O universal precision thread grinder shown in Fig. 14. The threads are ground from the solid on two surfaces of the shaft, the thread in one case being 3 15/16 inches diameter by 1 inch long, and in the other case, 3 7/16 inches diameter by 9/16 inch long. These threads are 12 per inch and of United States or American standard form. The propeller shaft is of S A E X4340 steel, and is hardened to from 290 to 321 Brinell prior to the thread-grinding operation.

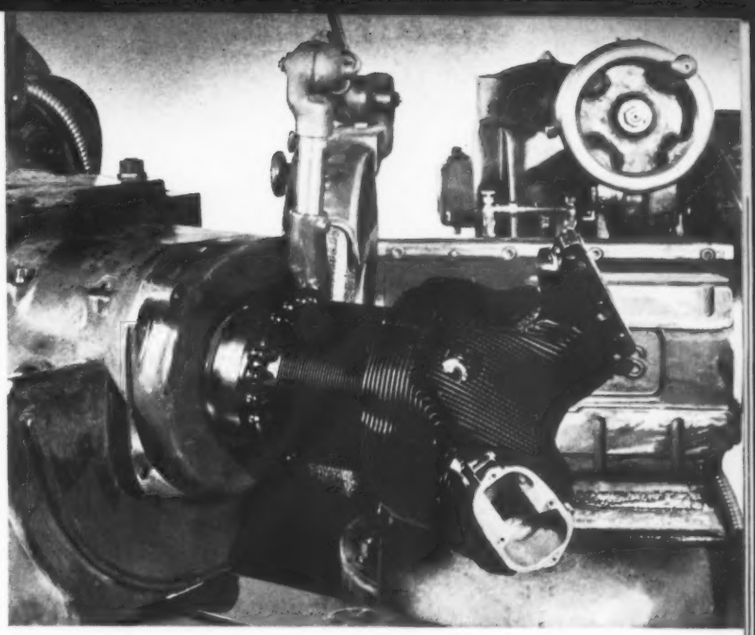


*Fig. 12. Grinding Both a Flange Face and a Shoulder on Cylinder Heads by the Use of a Wheel with a Beveled Face*

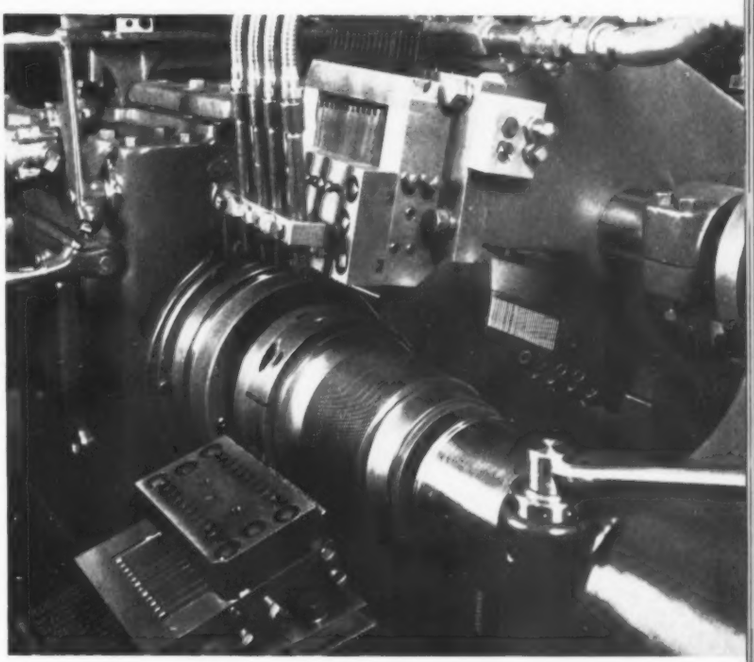
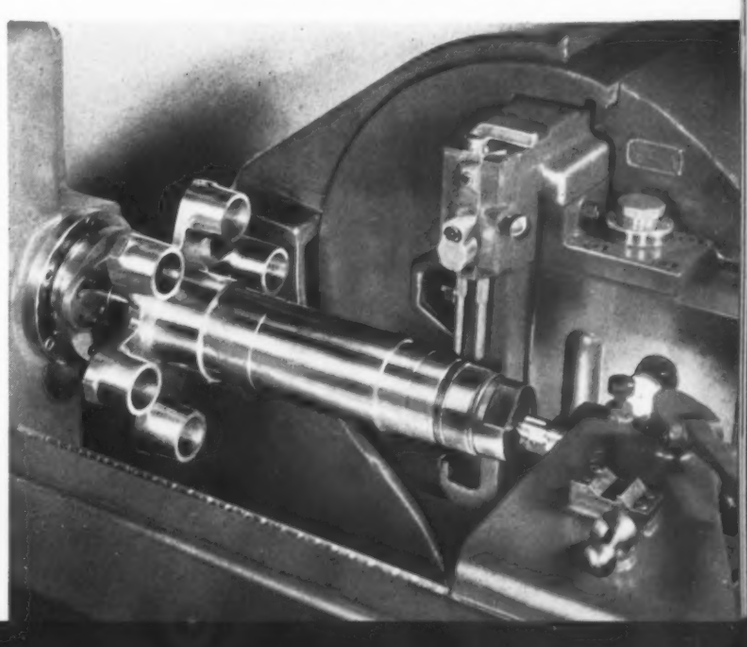


*Fig. 13. (Above) Machining Cylinder Barrels in a Fay Automatic. Fig. 14. (Below) Two Threads on This Propeller Shaft are Ground from the Solid*



*Mt. Fuji and Japanese Railway Shop — Courtesy of the Japan Tourist Bureau*

# Progressive Methods

JAPAN first became one of the leading buyers of American-built metal-working machinery in 1937, when it ranked second, with a total volume of $12,151,886, being approximately seven and one-half million dollars behind the United Kingdom. In 1938, it was second to Russia with a volume of business close to $24,000,000. Prior to those years the greatest annual sale of machinery of this kind to Japan was slightly over three and one-half million dollars. It has been estimated that, for the year 1939, Japan will again be second, with a total of $29,000,000—only $1,000,000 behind the United Kingdom.

Operations performed with American-built metal-working machinery in some of the most enterprising machine shops of the Japanese islands are illustrated in this article.

Two Acme-Gridley four-spindle, 6-inch, chucking automatics are used in a Japanese automotive plant for roughing and finishing steel castings of the type seen on the tool-slide in the lower right-hand corner of Fig. 1. The cylindrical portion of the castings is 2 1/2 inches diameter by 3 inches long. The roughing machine performs twelve operations on each part in a machine time of one minute and five seconds. The second machine, which is the one shown, takes nine finishing cuts in fifty-six seconds.

The application of an Ex-Cell-O precision thread grinding machine in a Japanese aircraft plant for grinding a modified buttress thread on one end of cylinder barrels is illustrated in Fig. 2. The thread is ground to a pitch diameter of 6.493 inches and is 0.940 inch long. The depth is 0.0903 inch, and the pitch 0.1676 inch. The thread has a load-resisting flank angle of 7 degrees 30 minutes, and a thread angle of 45 degrees, the tops of the thread being rounded to a radius of 0.035 inch, and the bottoms to a radius of 0.015 inch.

In this operation, the tolerance on the pitch diameter is only 0.0015 inch, and the lead tolerance is plus or minus 0.0002 inch. There can be no variation in the radii or in the thread form.

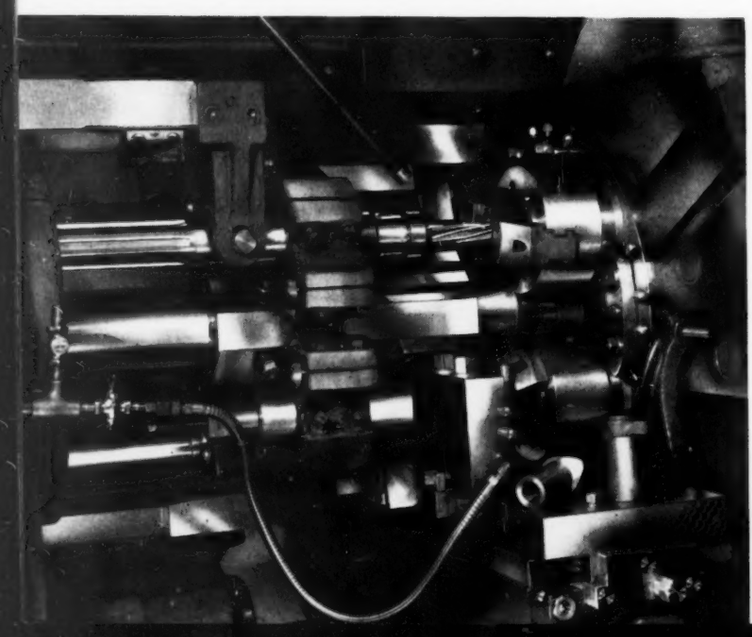


***Fig. 1. One of Two Chucking Automatics Used in Roughing and Finishing Small Steel Castings in a Japanese Automotive Plant***

# in Japanese Shops

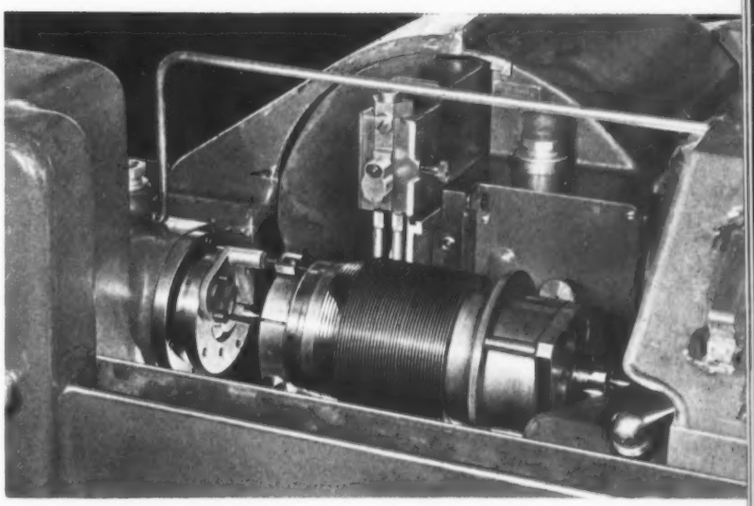
Ball bearing races of the style seen in the lower right-hand corner of Fig. 3 are being machined on a Hall Planamilling machine to such close limits of accuracy that when the pieces have been hardened, only a minimum amount of stock need be ground off. This machine, which is in operation in a Japanese shop, is tooled up to accommodate several different sizes of bearing races. Three or four races are chucked at a time on an arbor or in a collet and finished simultaneously at the rate of two or three pieces a minute. One operator can run several machines.

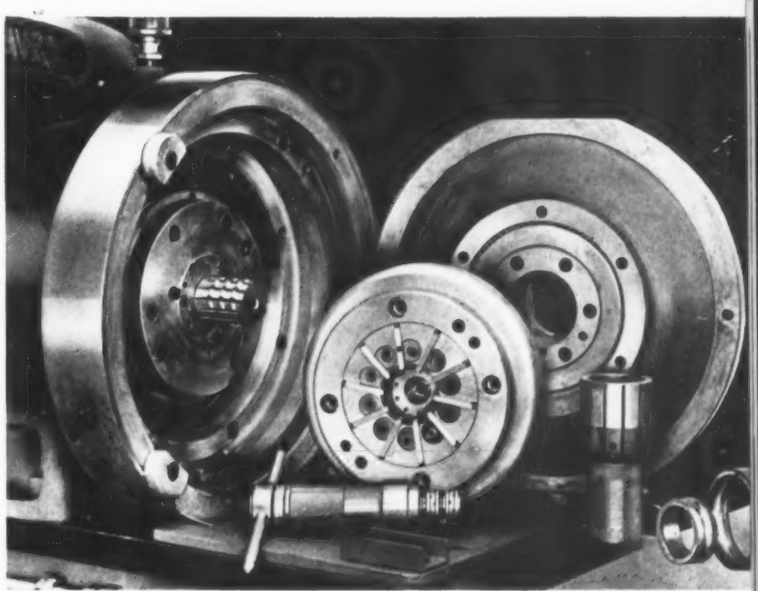
The operation consists of grooving either the inside or outside of the race, and at the same time, finishing the cylindrical surfaces on each side of the ball groove. The dimensions are held within plus or minus 0.001 inch. The cutters are ground to the form of the groove to be produced; it will be obvious from the illustration that the cutter seen in the machine was made for milling three races simultaneously. Tapered roller-bearing races can be handled by substituting the proper cutters.

Both vee and flat ways of small lathe beds are ground simultaneously in a Japanese shop by the use of a Thompson hydraulic surface grinding machine equipped with two grinding heads, as illustrated in Fig. 4. Both grinding wheels are form-dressed by means of truing devices mounted on the machine table.

Lathe beds are ground to a high degree of accuracy by this method, and in approximately one-third of the time required for hand-scraping. In addition, interchangeability of beds is attained.

Connecting-rods and caps for Japanese automobiles are broached across the half-round bearings and their joint faces in the Oilgear single-slide vertical broaching machine illustrated in Fig. 5.





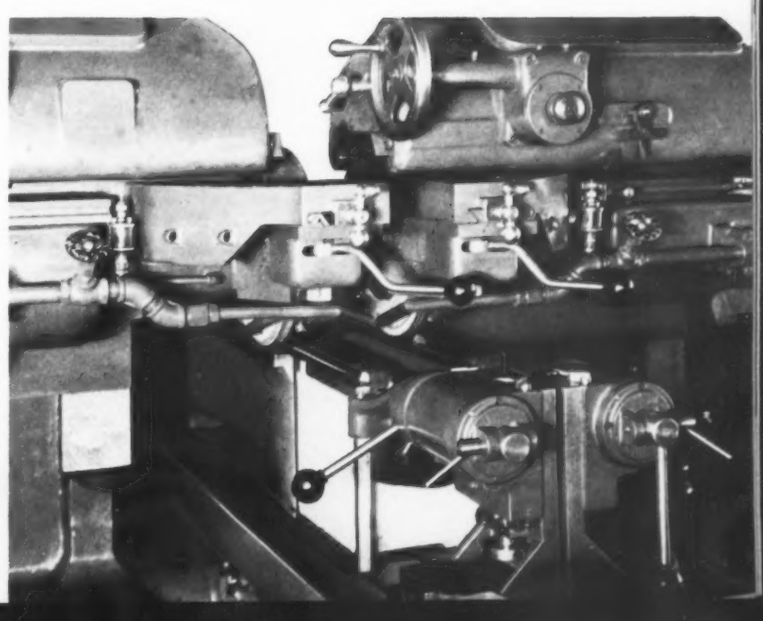
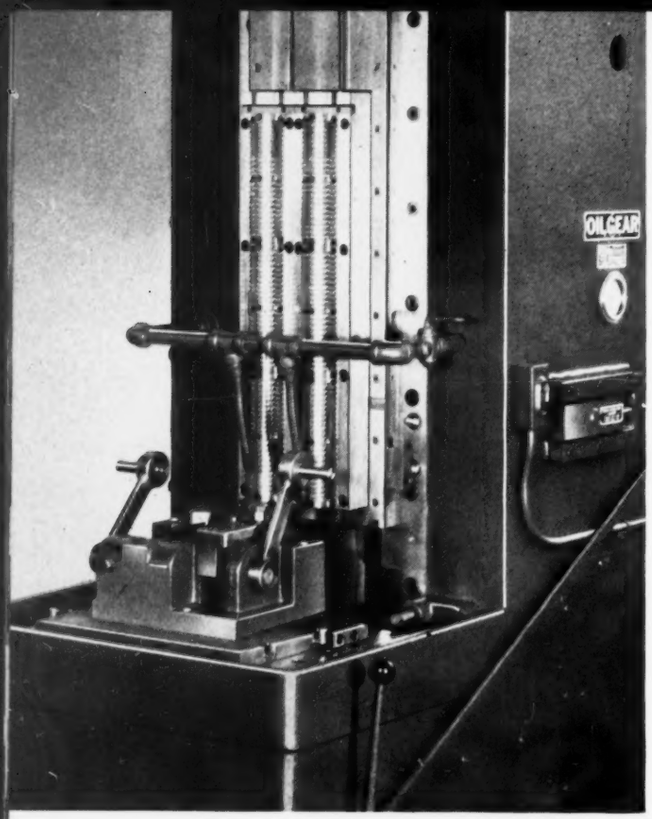
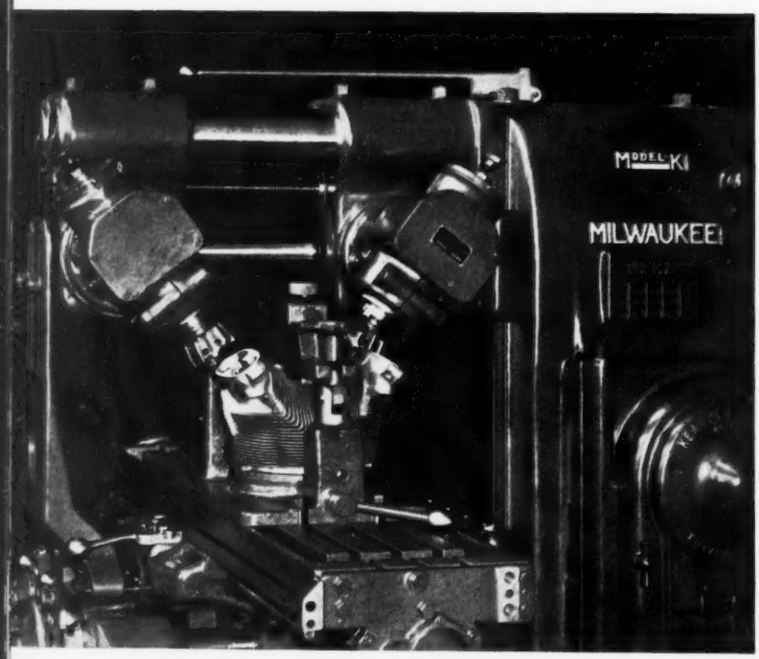


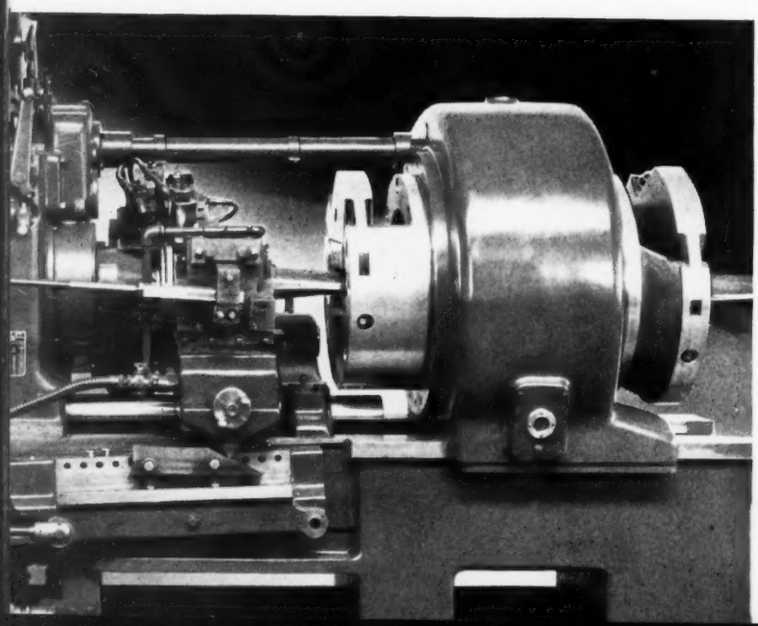
*Fig. 2. (Top) Grinding a Buttress Thread on Airplane Engine Cylinder Barrels*

*Fig. 3. (Center) Planamilling Machine Employed for Grooving Ball-bearing Races*

*Fig. 4. (Bottom) Grinding the Vee and Flat Ways of Lathe Beds Simultaneously*



A second machine of the same type, but provided with a different set of broaches and work fixture, broaches the sides of the bolt bosses on both rods and caps in a preceding operation, and also broaches the tops of the bosses on the rods and their adjacent shoulders.

In the operation illustrated, the production rate is 125 finished rods and caps per hour. The connecting-rod is located in the left-hand side of the fixture by placing the wrist-pin hole over a stub pin, and the previously broached sides and bolt bosses between hardened plates. Two lever-operated jaws are then moved to clamp the rod securely. The cap is located between plates on the right-hand half of the fixture, and a lever-operated double cam clamps it securely.

Two inclined pads on cylinder heads for airplane engines are milled simultaneously by the Model K Milwaukee milling machine illustrated in Fig. 6. The milling heads can be swiveled to obtain the desired angular settings. They can also be adjusted with respect to center-to-center distance, and their spindles are contained in quills that can be adjusted individually to and from the work. A special work-fixture is supplied.

An unusual set-up of a Fay automatic lathe for machining the hubs of propeller blades in a Japanese aircraft plant is illustrated in Fig. 7. The hub end of the propeller blade is supported by the air-operated headstock center, and the long blade receives additional support from two steadyrests incorporated in a special center drive unit. The machine functions in the conventional manner in that rough- and finish-turning cuts are taken by tools on the front carriage as it feeds along the bed, and rough- and finish-facing cuts by tools on the back arm as the arm swings forward toward the work.

Gear racks for turret lathes are cut in a Japanese shop by the Fellows rack shaper illustrated in Fig. 8. Racks with either spur or helical teeth can

*Fig. 5. (Top) Broaching Machine Used for Finishing Connecting-rods and Caps*

*Fig. 6. (Center) Milling Angular Pads on Opposite Sides of Airplane Cylinder Heads*

*Fig. 7. (Bottom) Fay Automatic Turning and Facing Airplane Propeller Blades*

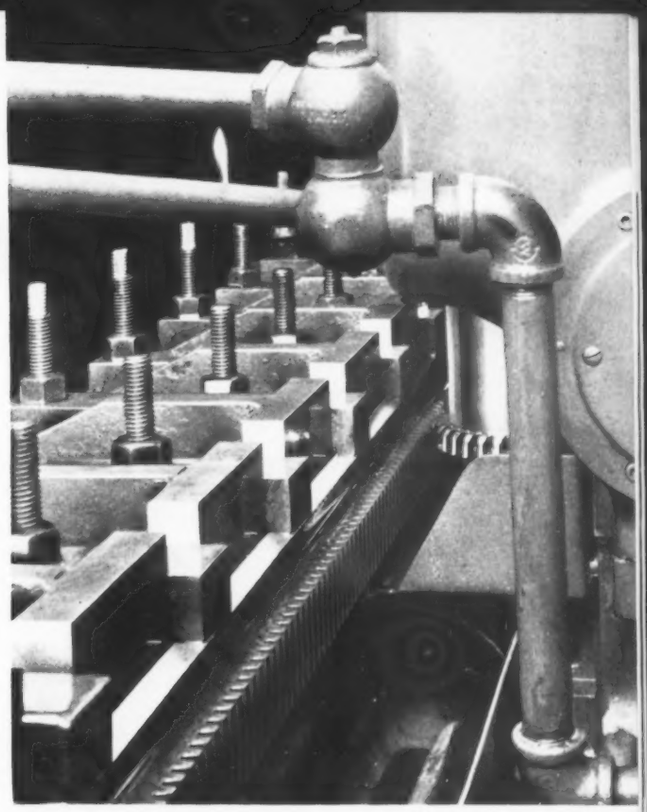
be cut on this machine. The work-table is fed longitudinally to carry the work past the cutter, the rotation of which is synchronized with the work through change-gears. The rack blanks are clamped to the table by toe-clamps and binder screws.

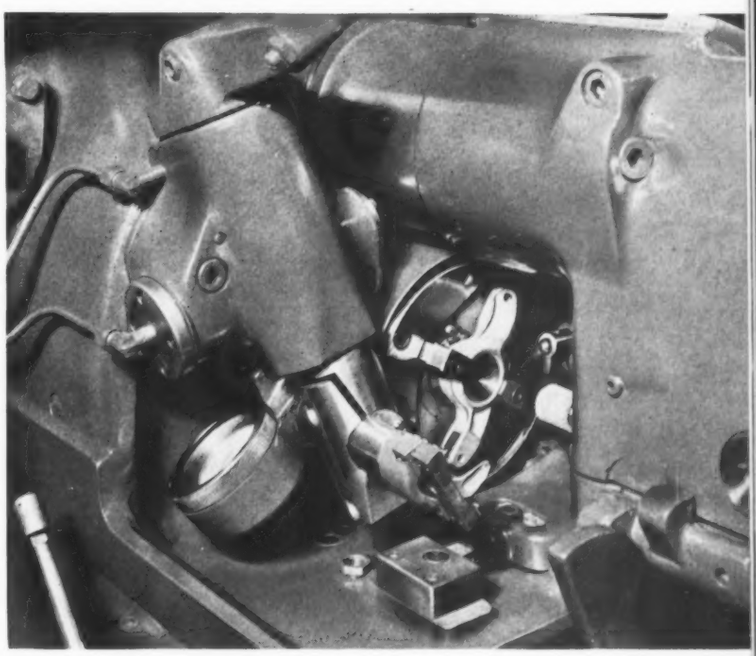
This machine is provided with complete electrical control and selector switches for automatic operation. The switches can be set for starting the tooth-cutting operation at either end of the work or in the center. The cutter is advanced toward the work at the beginning of an operation by means of a feed depth cam. Upon the completion of the operation, the cutter is automatically withdrawn to facilitate removal of the work and reloading. The electrical equipment is arranged to permit the finishing of racks in either one or two cuts.

Two machines of this type have also been shipped by the Fellows Gear Shaper Co. to shops in Italy.

Hardened-steel rocker arms of the construction seen in the chuck of the machine shown in Fig. 9 are ground in the bore at the rate of twenty-five pieces per hour. This operation is performed in a Japanese plant by a Bryant internal chucking grinder equipped with a sizing device, which shows the progress of the grinding wheel in removing stock and indicates when the operation is completed. Approximately 0.015 inch of stock on the diameter is ground from the bore, the required size being attained within limits of plus or minus 0.0005 inch.

Twelve holes are bored in propeller reduction gear assemblies for Japanese airplanes by the Heald Bore-Matic shown in Fig. 10. The operation consists of semi-finish- and finish-boring six pairs of equally spaced holes which serve as bearing seats for pinion shafts. Each pair of holes is bored to 1.1417 inches diameter within a tolerance of 0.0005 inch, a total of 0.025 inch of stock on the diameter being removed.





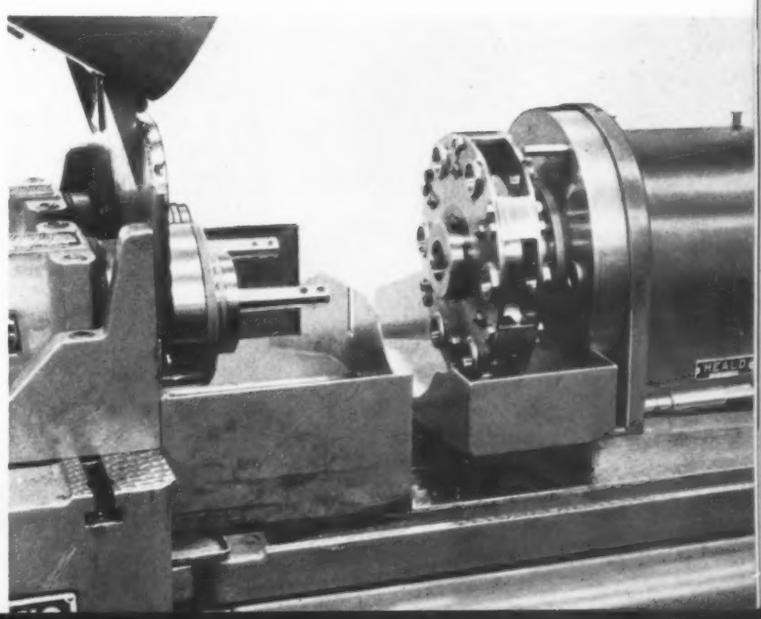


*Fig. 8. (Top) Cutting Gear-tooth Racks for Turret Lathes on a Fellows Gear Shaper*

*Fig. 9. Grinding Rocker Arm Bores on a Machine Equipped with a Sizing Device*

*Fig. 10. (Bottom) Precision-boring Twelve Holes in Propeller Reduction Gear Assemblies*

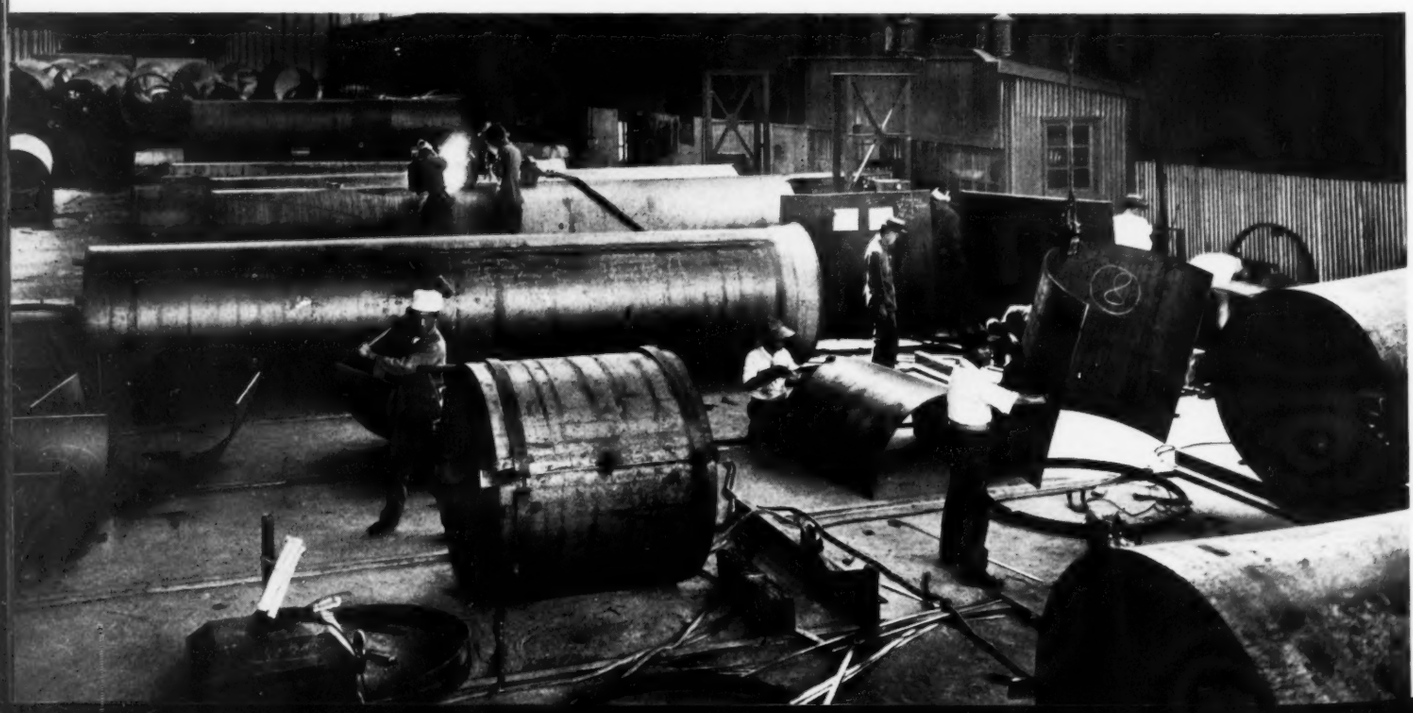
Two heads are provided for boring two sets of holes in the same pass of the tools. Each quill carries a front tool for roughing and a rear tool for finishing. The machine is provided with a jump cam by means of which the table feed accelerates to a rapid traverse as the tools travel through the gap between the two holes of each pair. Each boring head is equipped with retraction units which automatically back off the tools at the end of the boring stroke, so as to prevent drag lines on the work when the tools are returned to the starting position.

An indexing fixture enables all twelve holes to be bored in one set-up of the work. The part is located from a splined bore on a stake attached to the indexing spindle of the fixture, and is positioned relative to the spindle by means of a bore centering plug. The indexing spindle is secured in the various positions by means of a locking handwheel. The cam lever at the right of the fixture is employed for expanding plugs in the splines of the work for clamping purposes.

Arc-welding equipment supplied by the Lincoln Electric Co. is employed in the Kawasaki Dockyards in Kobe, Japan, for a large variety of work. Fig. 11 shows a general view of a shop in which this welding equipment is being applied in the fabrication of water pipe from 1300 to 2100 millimeters (4 feet 3 inches to 6 feet 11 inches) in diameter. Sections of pipe are rolled hot and then butt-welded together with filler strips. The 6-meter (20-foot) long sections are flanged hot at one end.



*Fig. 11. General View of a Structural Fabrication Shop in Japan where Lincoln Arc Welders are being Employed in the Fabrication of Large Water Pipe*



# Engineering News Flashes

## *The World Over*

### Prospecting for Minerals by Chemical Analysis of Plant Leaves

A new method for discovering the presence of mineral deposits has been suggested by two Swedish scientists. They state that if a mineral is present in the earth, the water in that area will bear traces of it. Trees and shrubs will absorb this mineral-bearing water solution, and traces of the mineral will be present in their leaves. When the leaves are examined by laboratory methods, they will reveal whether or not there are minerals in the area in which the trees grow. It is stated that experiments so far made with this method of prospecting have proved successful.

### Some of the Engineering Details of the Antarctica Snow Cruiser

Considerable newspaper publicity has recently been given to the snow cruiser built by the Research Foundation of the Armour Institute of Technology, Chicago, for use in exploring the south polar region. Some of the technical details pertaining to this equipment may be of interest. The giant vehicle is 55 feet long, 20 feet wide, and 15 feet high. It is a self-contained unit, to be used both for transporting and housing four scientists as they explore the Antarctic regions. The vehicle has a cruising range of from 5000 to 6000 miles. It will be equipped with a year's food supply. On its broad back is mounted an airplane for making short dashes with the cruiser as a base. The equipment weighs in the neighborhood of 75,000 pounds.

The cruiser is mounted on four wheels like the conventional automobile. These wheels, with pneumatic tires, are 10 feet in diameter and so arranged that the cruiser can pass over crevices up to 15 feet wide. Two 150-H.P. Diesel engines furnish the driving power at a normal speed of 20 miles an hour.

The driver can apply the power of one or both of the Diesels, to any one, two, or three of the wheels, or all of them. He can apply the brake on the two front or the two rear wheels separately or simultaneously. He can lift or lower the wheels separately or in pairs. He can steer front and back wheels so as to travel obliquely, sidewise, backward, or forward, and turn in a 30-foot radius. All in all, the snow cruiser offers a degree of control probably never before built into a vehicle.

### The World's First Cog-Railway Diesel-Electric Locomotive

The world's first rack-rail Diesel-electric locomotive has been built by the General Electric Co. for the Manitou and Pike's Peak Railway, the highest cog railway in the world. The new locomotive replaces the tilted steam locomotives which for almost fifty years have been pushing sightseers to the summit of America's most famous mountain. Contrary to ordinary practice, the fifty-passenger car on this unique railway is pushed rather than hauled by the locomotive. The new Diesel-electric locomotive is arranged to provide traction at the wheels, as well as the rack-rail, but not simultaneously. It has two axles, weighs 20 tons, and is powered by three Diesel-electric generating units. Each unit is rated at 160 H.P. at 1800 feet above sea level, but at the top of Pike's Peak—an elevation of 14,109 feet—the rating is about 100 H.P.

The trip to the Peak starts from Manitou at an elevation of 6562 feet. One hour and ten minutes is required to climb the 8.9 mile ascent to the very top. The average grade is 16 per cent, the steepest climb being 25 per cent. On the downward trip, the locomotive simply backs down the grade in front of the passenger car. Dynamic braking assists in holding the car at a safe speed in descending the steep slopes.

### Industrial "Stethoscope" Analyzes Condition of Machinery

An industrial "stethoscope" for the use of acoustic engineers in testing machinery has been developed by Electrical Research Products, Inc., 195 Broadway, New York City. Just as a doctor listens to the heartbeats of his patient and records his condition, so the "recording frequency analyzer," as the new device is called, takes note of sounds in machinery being tested and records the results automatically on a graph. The engineer obtains a completely plotted and permanent record of the sounds at various frequencies. Having tested both good and defective machines in this manner, he will be able to tell, from the sound peaks at certain frequencies, when there are defects causing noise in the machine being tested. Laboratory models of the new device have been instrumental in tracing mysterious sounds in motors and other machinery revolving at high speed.

# EDITORIAL COMMENT

## Machine Shop Training Once More a Pressing Problem

With the increasing demands placed on the machine-building industries comes the pressing need for trained workers. Notwithstanding the unemployment figures so frequently published, machinery manufacturers in practically all machine-building centers experience difficulty in finding men with adequate skill and training. Hence, the problem of how to increase the supply of trained machine shop workers is again with us.

There are two distinct types of training required. One is the training of apprentices to become all-around skilled workers—the training of young men to become the future supervisors, foremen, inspectors, and service men in industry. This training requires that once more emphasis be placed on the time-honored four-year apprenticeship program.

The other group of workers required in the machine industries comprises men capable of operating one type of machine only, turret lathe operators, grinding machine operators, milling machine operators, etc. This training, past experience proves, can be given in from two to six months, depending on the character of the work to be done. Such training makes it possible to take unskilled men into the shops and, in a comparatively short time, teach them to become what might be called skilled operators on a single type of machine.

## Employment is More Easily Found by the Trained Man

As one of the means for increasing the available supply of skilled and semi-skilled men, it has been suggested that a large number of CCC and WPA workers, carefully selected to make sure that they will be suitable for this class of work, might be placed in arsenals and navy yards, or in special training schools, to obtain adequate experience for operating single types of machines. This idea, if properly carried out, should give satisfactory results, in addition to benefiting the individual who receives the training. It would make fewer men dependent on the Government for their livelihood, since it would place them in a position of being self-supporting.

Whatever the means adopted may be, the fact remains that there is at present a scarcity of properly trained workers for the machine industries—men capable of satisfactorily performing the work that the machine industries require to be done. For such men there is employment.

## Industry Pays $576 to the Government for Each Worker Employed

The American Federation of Investors, Inc., Chicago, Ill., has made a comprehensive compilation for the fiscal year 1938, covering 163 business corporations representative of a cross-section of industry and employing 3,000,000 people. This compilation shows that an average of $576 is paid annually in taxes per employe by these 163 companies.

It is also significant to note that, in 1938, the dividends per common share in these corporations were $1.33, while the taxes per common share were $2.73. In other words, the Government took in taxes more than twice what was left as a return on the investment to those who had spent their money to build the factories and equip them with machinery, thereby providing an opportunity for employment and making possible the earnings and livelihood of 3,000,000 workers. It should also be remembered that after the investor has received his dividends, he, in turn, has to pay a personal income tax, so that the Government gets him coming and going.

Taxes are necessary to maintain Government functions; but when a Government becomes extravagant and wasteful of public funds and levies taxes that, in some instances, can be described by no other term than "confiscatory," then it is time to call a halt. The average worker thinks that he escapes taxation; but if an employer has to pay, as this compilation shows, some $575 a year for the privilege of employing each worker, the tax must ultimately come out of either the worker's wages or the price that he has to pay for the manufactured products. Ultimately, the consumer must pay the tax. In the meantime, however, great business enterprises may be ruined by excessive taxation; and unemployment follows as an unavoidable result.

# Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

## Novel Intermittent Feeding Mechanism

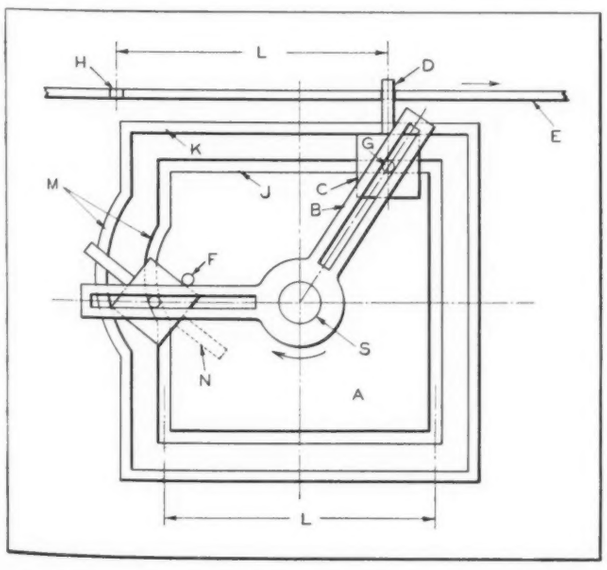
By PAUL GRODZINSKI

The mechanism shown in the accompanying illustration is designed to intermittently index or feed a block chain or film *E* longitudinally from left to right. Each feeding movement advances the chain or film a distance *L*. The indexing is accomplished by a pin *D* which enters equally spaced holes or slots *H* in the chain, rising vertically into one of the slots and moving to the right until the chain has been moved a distance *L*. The pin then moves downward out of contact with the chain. With the simplest arrangement of this mechanism, using only one arm *B*, and without the block-rotating device *M* described later, the chain is fed a distance *L* for each revolution of shaft *S*, the feeding movement taking place during about one-fourth revolution of shaft *S*.

Pin *D* is carried in a square block *C*, which has a pin *G* that guides the movement of block *C* in a rectangular path determined by cam groove *J*. Pin *G* also enters a slot in the driving crank *B* attached to rotating shaft *S*. Block *C* is further guided in its rectangular path by rim *K* on the body *A* of the mechanism, which also has the cam groove *J*. Rim *K* prevents block *C* from turning about pin *G*, so that pin *D* will rise vertically into the slot in chain *E* for the feeding movement.

By modifying the forms of groove *J* and rim *K* as shown at *M*, and providing a stationary pin *F* in body *A*, it is possible to cause block *C* to rotate through an angle of 90 degrees. With this arrangement and only one block *C* and one driving crank *B*, pin *D* would be brought into the indexing position every fourth revolution of shaft *S*. By adding another pin *N* to block *C*, the chain would be indexed every second revolution of shaft *S*. Irregularity of the timing of the indexing movements or a variation in the number of indexing movements per revolution of shaft *S* can be obtained by employing more than one slotted crank *B*.

A variety of indexing movements can be obtained by varying the design. For example, block *C* can be fitted with one, two, three, or four pins *D*, and block-rotating arrangements *M* can be provided on the bottom and right-hand side of the mechanism.

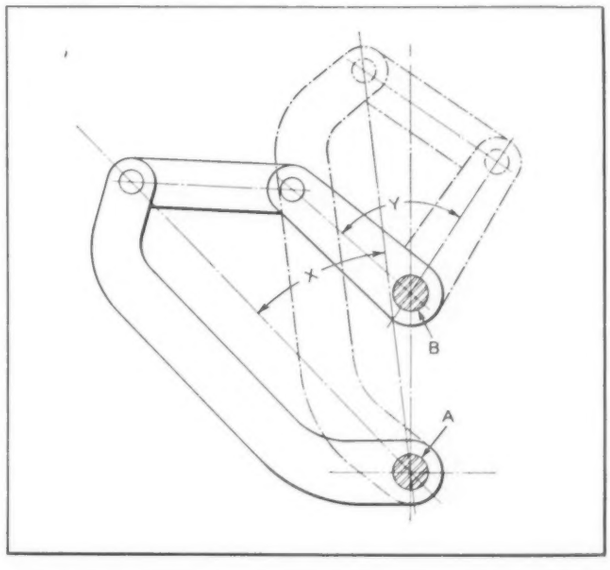



Mechanism that Imparts Intermittent Movement to Chain E

## Link Mechanism for Increasing Angular Movement of Shaft

By JERRY L. HELMINEN

In the accompanying illustration is shown an arrangement of links and levers for transmitting an oscillating movement from shaft *A* to shaft *B*. The




Mechanism for Increasing Angular Movement of Shaft B

mechanism is designed to oscillate shaft *B* through angle *Y*, which is greater than angle *X* through which driving shaft *A* oscillates. This mechanism is intended to accomplish the same purpose as the one described on page 20 in the September number of MACHINERY, but is a somewhat simpler design.

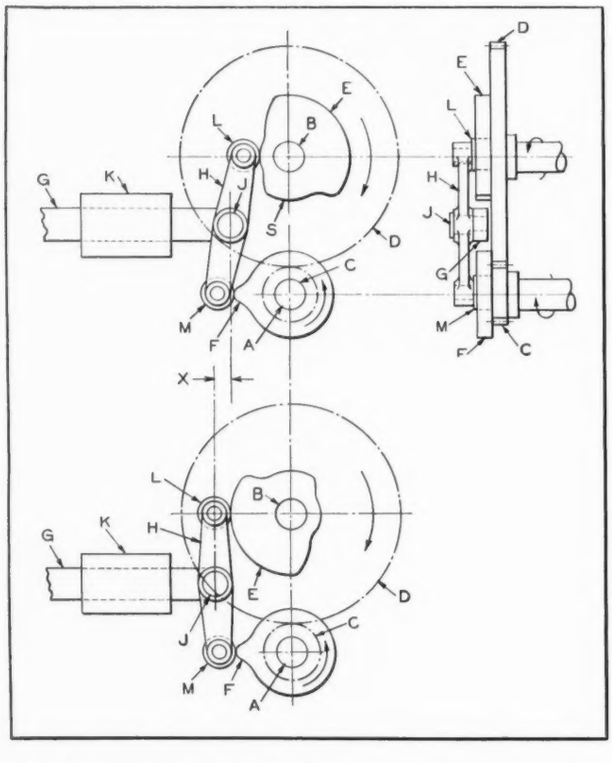
---

## Pivoted Holder for Cam Follower Rolls Provides Unusual Reciprocating Motion

By L. KASPER

The design of an interesting mechanism used on a wire-forming machine is shown in the accompanying illustration. This mechanism is used to operate a slide *G* which carries a forming tool, the slide being caused to reciprocate from three different positions. The lower cam *F* imparts the reciprocating movements to the slide, while the upper cam *E* intermittently locates the slide *G* in three different positions.

Referring to the illustration, the shafts *A* and *B* carry the meshing gears *C* and *D* which rotate in the directions indicated by the arrows. Shaft *A* is the driving member, shaft *B* running idle in its bearings. Cams *E* and *F* are attached to gears *D* and *C* and operate with them. The speed ratio between gears *C* and *D* is 4 to 1. The slide *G* is supported in bearing *K*. Slide *G* carries the stud *J*, upon which lever *H* fulcrums at its center. Lever *H* carries the rollers *L* and *M*, which engage the cams *E* and *F*, respectively, being held in contact by a spring (not shown) which draws slide *G* to the right.




Mechanism for Automatically Reciprocating a Slide and Locating it in Three Different Positions

Cam *E* is designed with three points of rest, one of which is for a period of 180 degrees, while the other two are for periods of 90 degrees each. The single-lobed cam *F* is designed to give a quick rise and fall. In the upper view to the left, the roller *L* is shown on the low point of cam *E*, while the roller *M* is positioned on the high point of cam *F*. As the lobe of cam *F* passes under the roller *M*, the lever *H* fulcrums on the center of the roller *L*, transmitting to the slide *G* a movement equal to one-half the rise of cam *F*.

As gear *D* rotates in the direction indicated by the arrow, the intermittent step *S* of cam *E* is brought under roller *L*, causing lever *H* to fulcrum on the center of roller *M*, thus moving the slide *G* to the left an amount equal to one-half the rise of step *S* on cam *E*, slide *G* now being in its second or intermediate position. The lobe of cam *F* again actuates the lower end of lever *H*, giving the slide *G* its second reciprocating movement from its new position.

Continued rotation of gears *C* and *D* brings the high point of cam *E* under roller *L*, as shown in the lower view. As compared with the upper view, the position of the stud *J* has moved to the left a distance equal to *X*. As the high point of cam *E* includes 180 degrees, the lobe of cam *F* acts twice on the roller *M* during this period. Thus the slide *G* is given one oscillating motion at each of two positions and two motions at the third position. The roller *L* then returns to the low point on cam *E*, completing the cycle. The slide bearing *K*, it will be noted, is not shown in the side view of the assembly.

* * *

## Engineering Courses for Home Study

The Extension Division of the University of Wisconsin, which teaches many technical subjects by correspondence, announces a home study course in machine design for students who have had at least one year in college and who have completed the required courses in mathematics and drawing. This course will carry college credits. An elementary course in mechanism is also offered for those who do not require college credits. Inquiries may be addressed to the University Extension Division, Department of Mechanical Engineering, University of Wisconsin, Madison, Wis.

* * *

Business has furnished the tax base which has made possible mass education, and a highway system and cheap automobiles which have given the American citizen a wider cruising range and a broader horizon than is possessed by the citizen of any other nation.—*New York World-Telegram*

# James Emmett Gleason Awarded the A. S. M. E. Medal

James Gleason, President of the Gleason Works, Who has Just been Awarded the A.S.M.E. Medal

THE A.S.M.E. gold medal for 1939, the highest honor that the American Society of Mechanical Engineers can bestow upon a fellow engineer, has been awarded to James Emmett Gleason, president of the Gleason Works, Rochester, N. Y., and a member of the Society. The presentation ceremony took place at the annual dinner, Wednesday, December 6, during the sixtieth annual meeting of the Society at the Bellevue-Stratford Hotel in Philadelphia, Pa. The citation of the Committee on Awards said: "Through his technical and engineering contributions, James Emmett Gleason has given distinguished service to the automotive industry by making possible better and safer gear drives. Helped by his keen judgment and kindly nature, he has surrounded himself with an engineering force that has cooperated with him in making their inventions available to the industry through the building of machinery for the production of gears that are found in all parts of the manufacturing world."

Mr. Gleason, after graduating as a mechanical engineer from Cornell University, worked with his father, William Gleason, in the design and building of machine tools at the Gleason Tool Co., founded by his father in 1865. In 1905, James Gleason obtained patents on a two-tool bevel-gear generator, a machine for cutting both sides of bevel-gear teeth at the same time. Up to this time, accurately formed bevel gear teeth had been cut by machining one side of a tooth at a time; a bevel-gear planer working on this principle had been patented by William Gleason in 1874. The first of these bevel-gear planers is now on exhibition at Henry Ford's Dearborn Museum.

In 1913, James Gleason developed the spiral-bevel gear generator, the first machine of its kind. Machines of this type are now used extensively in this country and abroad, especially in the automotive industry. They provide the smoothness and quietness in bevel gears that the automobile calls for. The spiral-bevel gear generator contains many elements that were later embodied in the hypoid-gear generator, also developed and produced by the Gleason Works.

Mr. Gleason is president and general manager of the Gleason Works, Rochester, N. Y. In 1926-1927 he was president of the National Machine Tool Builders' Association; he has also been president, and is now a director, of the Rochester Chamber of Commerce, and is a director of the Lincoln-Alliance Bank & Trust Co., a trustee of the University of Rochester and of the Rochester Bureau of Municipal Research, and a director of the Rochester Athenaeum and Mechanics Institute.

---

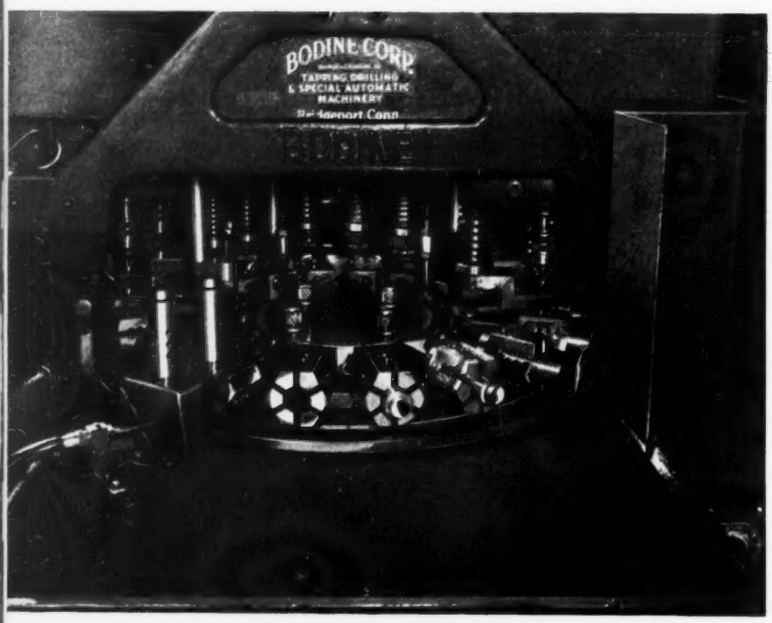
## Simplified Practice Recommendation for Die-Head Chasers

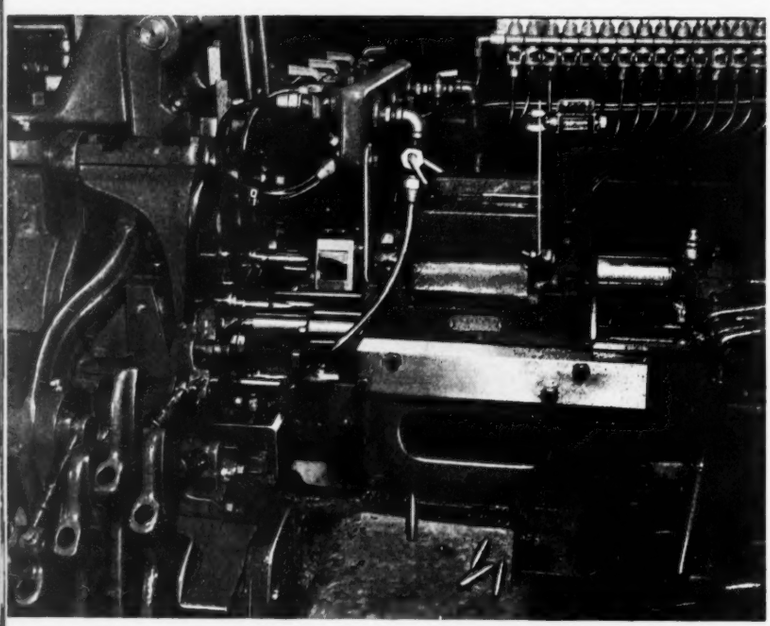
The National Bureau of Standards, Washington, D. C., has announced that Simplified Practice Recommendation R51-29, covering die-head chasers for self-opening and adjustable die-heads, has been reaffirmed without change by the standing committee of the industry. This recommendation covers sizes and number of threads per inch for die-head chasers carried in stock.

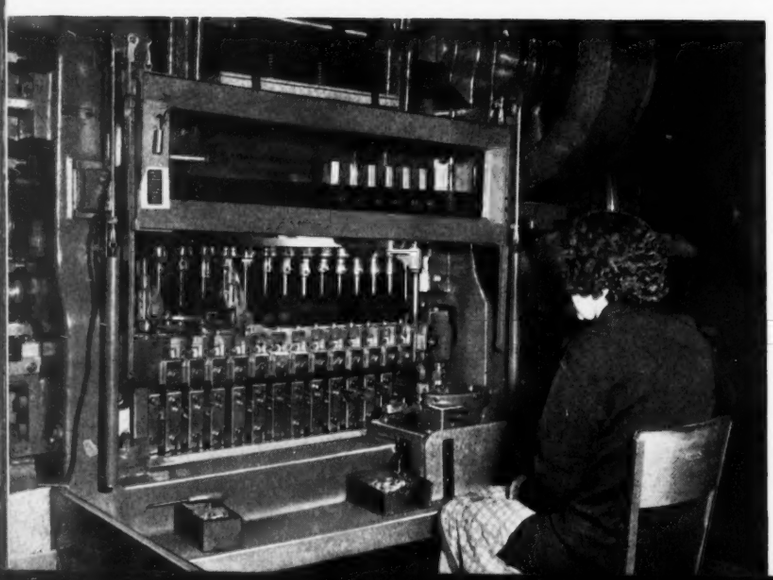
The fact that industry has so frequently reaffirmed the simplified practice recommendations adopted in the past, is a clear indication of the value of these recommended practices. The present reaffirmed practice, for instance, was originally proposed and prepared by the industry in 1926. It was revised in 1927, and again in 1929, and reaffirmed in its revised form in 1931, and again in 1937. Copies of the recommendation can be obtained from the Government Printing Office, Washington, D. C., at 10 cents each.

# Manufacturing Small-Arms Ammunition

By COLONEL EDWIN D. BRICKER
Commanding Officer





IN an article "Producing Projectiles at Frankford Arsenal," which appeared in July MACHINERY, page 748, operations performed in one of three manufacturing divisions of the Frankford Arsenal, Philadelphia, Pa., were described. The present article will deal first with an additional operation in the Artillery Division, after which some of the production methods employed in the Small-Arms Ammunition and Instrument Divisions will be described.

An unusual machine for drilling eighteen holes around cartridge containers is shown in Fig. 11. The work-pieces are slipped into split horizontal chucks that are indexed counter-clockwise beneath nine drill spindles. These spindles are arranged in groups of three for successively drilling holes of 3/16 inch diameter along the same center lines. After each group of three holes has been drilled, an indexing member on the rear side of the chucks is positioned beneath a vertical rod that moves downward with the head of the machine. When this rod comes in contact with the indexing member, the chuck is turned 1/6 revolution, thus presenting a new portion of the work for drilling by the next series of three drills. Each piece of work is indexed three times in one passage around the machine and nine holes are drilled. The remaining nine holes are drilled in a second feeding.

The Small-Arms Ammunition Division is equipped with a vast amount of highly special machinery developed over a long period of years for quantity production manufacture. Between 100,000,000 and 150,000,000 rounds of ammunition are produced yearly for revolvers, automatic pistols, rifles, semi-automatic rifles, and machine guns. A limited amount of new machinery has been installed recently, including a battery of Davenport automatics. Fig. 12 shows

*Fig. 11. (Top) Multiple-spindle Indexing Type of Machine Devised for Drilling Eighteen Holes around Cartridge Containers*

*Fig. 12. (Center) Producing Armor-piercing Bullets from Tungsten Steel in a Five-spindle Automatic*

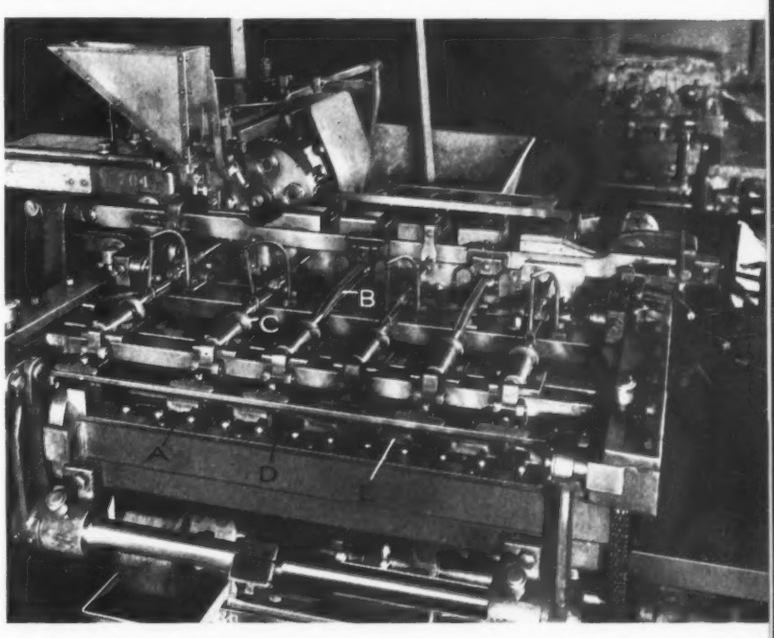
*Fig. 13. (Bottom) Assembling Bullets and Their Jackets in a Press Having Fifteen Available Die Positions*

# and Instruments at Frankford Arsenal

one of these machines producing armor-piercing bullets from bars of tungsten steel. The bar stock is fed forward to a stop opposite the bottom position of the work-carrier, after which the point and body of the bullet are turned by forming tools in successive stations of the machine, the bullet finally being cut off from the bar by a tool on the front slide. Nine machines of this type are engaged in producing armor-piercing bullets, and others are employed for trimming bullet jackets.

Other recent installations are Waterbury-Farrel presses of the type seen in Fig. 13, which assemble the bullets and their jackets. The jackets and bullets are fed from separate hoppers and advanced from station to station across the machine by a reciprocating transfer bar. Ratchet fingers move the bullets from position to position and hold them until punches enter and seat them in the dies. When the pieces are thus held, the transfer bar moves back to pick up the pieces in the preceding station. Therefore, with each cycle of the bar, the entire line of pieces is moved ahead the distance of one station.

There are fifteen stations available on the machine, but only ten are utilized in the operations shown. In the first station, the jacket is inserted automatically in the transfer bar, the machine stopping if a jacket is too long or inverted, or if the mechanism fails to feed a jacket. Pointing of the jacket is performed in the second, third, fourth, and fifth operations, and completion of the profile is accomplished in the sixth station. Burrs are removed from the jacket and the bullet core inserted in the seventh station. Inspection occurs in the eighth station, the machine being automatically stopped if a bullet has not been loaded into a jacket. Crimping and point-seating are performed in the ninth station and sizing of the bullet in the tenth. In the final station, the bullet is pushed through a die, from which it falls down a chute and into a



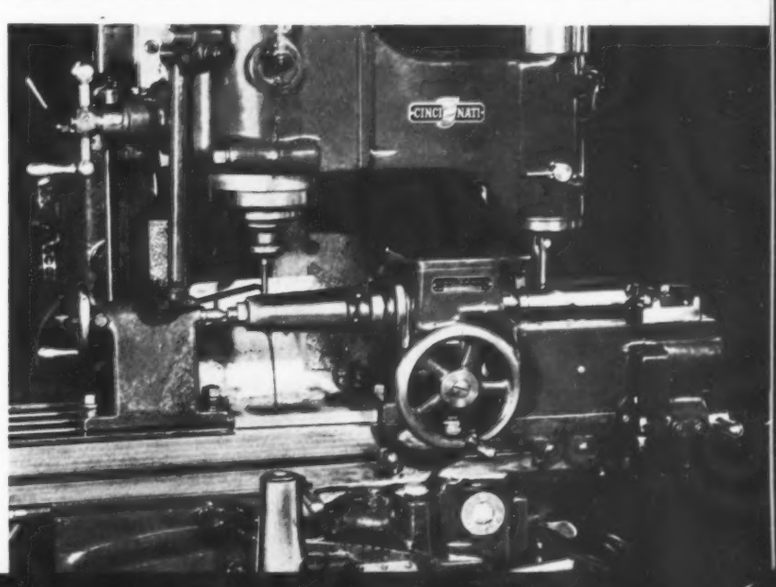




*Fig. 14. (Top) Automatic Machine which Inspects Assembled Bullets and Discards Those that Fail to Pass Inspection*

*Fig. 15. (Center) Close-up View of the Ingenious Mechanisms Incorporated in the Inspection Machine Shown in Fig. 14*

*Fig. 16. (Bottom) Vertical Milling Machine Arranged for the Automatic Roughing and Finishing of Cams from a Master*

*Fig. 17. Taking Four Boring and Three Facing Cuts on a Heat-treated Aluminum Casting in One Operation*

*Fig. 18. Typical Milling Operation Performed by a Horizontal Boring Mill on a Yoke Fabricated from Welded Steel*

container. At the time the photograph shown in Fig. 13 was taken the guard was raised in order to give a clear view of the mechanism.

An ingenious machine which automatically inspects loaded bullets for dimensions and weight is shown in Figs. 14 and 15. The bullets are automatically transferred from a hopper to an indexing wheel, and inserted into bushings in the wheel horizontally for a portion of their length. As each bullet is indexed from the loading station a pressure of 20 pounds is exerted through a bar against the head of the bullet to push it completely into the bushing. In the event that a bullet case is deformed or too large in diameter to be pushed fully into the bushing, the machine will stop automatically.

Each bullet is discharged from the indexing wheel to a reciprocating transfer bar that extends the length of the machine and carries the bullets to a succession of inspection stations, where they are checked for the length from the shoulder to the head, the over-all length, the cannelure diameter, the condition of the primer, the diameter of the head, and the head thickness. The bullets are carried crosswise by the transfer bar.

As each bullet starts on its journey to the various inspection stations, a ball moves directly in line along the front side of a conveyor screw *A* at the front of the machine, as seen in Fig. 15. At each inspection station, a rocker arm such as seen at *B* comes in contact with the bullet, and if the dimension being checked is within the desired limits, the opposite end of the rocker arm can enter a hole in the center of a knurled head *C* on a plunger at the front of the machine and no movement is imparted to the plunger. However, if a bullet does not pass inspection, the rocker arm *B* will be tilted sufficiently to prevent the front end from entering the hole in the knurled head, with the result that the plunger will be pushed toward the front of the machine. This action causes a corresponding finger *D* to "kick" the ball directly in line with the defective bullet from the front to the rear side of the conveyor screw. The ball, in passing under a cam *E*, causes a latch to be opened beneath the work transfer bar, permitting the defective bullet to fall into a container.

When a bullet that passes all the inspections reaches the right-hand end of the transfer bar, it falls on one of the arms of a revolving wheel. Bullets with a light powder charge fall off the arms into a discard box, while those that meet the weight requirements pass on to a box for bullets that pass inspection. The transfer bar which carries the bullets to the successive inspection stations of this machine rises at the end of each cycle, moves to the left, is lowered on the bullets to be transferred, and returns to the right to complete another cycle. Fifty bullets are inspected per minute by a machine, and one girl tends two machines.

Whereas the Artillery-Shell and Small-Arms Ammunition Divisions are tooled up for manufacturing the same products year in and year out, the Instrument Division is organized more on a jobbing shop basis, due to the fact that the work varies considerably and only limited quantities of any type of instrument are ordered at a time. Among the new machines in this division is a Cincinnati vertical milling machine, shown in Fig. 16 equipped for automatically milling cams of the type seen on the front of the machine knee. A master cam is mounted at the right of the table fixture for imparting vertical movements to a tracer as the cam revolves and as it is fed toward the left.

This tracer operates hydraulic valves, causing similar movements to be imparted to the cutter-spindle, so that the work-piece is milled to exactly the same contour as the master cam. The end of the cutter is ground to the same outline as the tracer, and it is of the same diameter, 1/4 inch. It is made with two flutes. The cams are produced from a Nitralloy steel. It required approximately two weeks for rough- and finish-milling these cams by the methods formerly used, whereas with the machine shown, the roughing cut can be completed in one day and the finishing cut in another day.

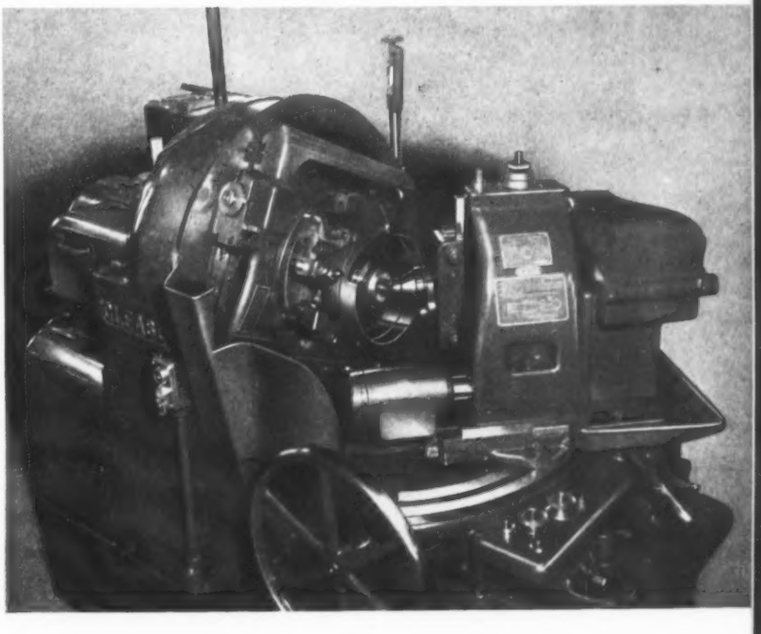
A Heald Bore-Matic is shown in Fig. 17 being used for the accurate boring of a heat-treated aluminum-alloy housing. Tungsten-carbide tools machine four bores and three faces in one operation, all of the tools being mounted on a built-up cutter-head. After a number of these housings have been rough-machined, they are finished in the same machine after changing the cutter-bar. On one of the bores, which has a nominal diameter of 3.1500 inches, limits of plus 0.0006 inch minus nothing must be maintained. Tolerances of 0.0015 and 0.002 inch are allowed on greater diameters and lengths. A machine of the same type is set up with a fixture for finishing three other bores and two faces on the same housing with respect to a second center line.

A large variety of work is assigned to the Giddings & Lewis boring mill shown in Fig. 18; this illustration shows a milling cut being taken on a medium-sized part of welded steel construction. The narrow-face large-diameter cutter is mounted on a head that operates on a heavy rail, supported at one end by the machine column and at the opposite end by an outer column. Boring and end-milling cuts are taken on the same work while it is held in other positions. Specified dimensions must be met within plus 0.005 inch minus nothing.

In Fig. 19 is shown a typical operation on one of four new Warner & Swasey turret lathes. The tooling illustrated reduced an eight-hour operation on fuse-setters to one hour. The long cylindrical part is drilled by a tool on one face of the hexagon turret, bored by a second tool on

*Fig. 19. Operations on a Fuse-setter which Formerly Required Eight Hours are being Performed on This Turret Lathe in One Hour*

*Fig. 20. Small Spiral Bevel Gears Such as Shown at the Front of the Table are Produced on the Machine Illustrated*



the turret, rough form-bored by a third tool, finish form-bored by a fourth tool and then supported on the overhanging end by a revolving center, as shown, while an external forming cut is taken with a tool on the indexing toolpost. The hole in this part must be finished to a high degree of accuracy, in order to insure that it will fit closely the contour of the fuse to which it is to be assembled.

Spiral bevel gears and pinions of small sizes, such as seen at the front of the machine in Fig. 20, are produced on the Gleason 6-inch spiral bevel and hypoid gear-cutting machine illustrated. In the particular operation shown, a spiral miter gear of 1.250 inches pitch diameter, with forty teeth, is being cut from a steel alloy. A tolerance of 0.002 inch is specified for the pitch diameter.

Several Pratt & Whitney jig boring machines of the advanced design shown in Fig. 21 have been installed for performing the many operations of exceptional accuracy required on military instruments. This machine is equipped with a circular tilting table that can be accurately placed in angular planes by means of a ring graduated to two seconds. In the operation shown, an azimuth scale, 20 inches in diameter, is having sixteen holes drilled around a circle that must be closely concentric with the inside and outside ring diameters. Close limits are also held on the spacing.

The machining of angular surfaces on some parts of complicated design can be performed to best advantage on milling machines equipped with a conventional slotting attachment, as shown in Fig. 22. The tool ram is reciprocated through the action of an eccentric, driven by the regular spindle of the Milwaukee milling machine. The slotting head can be swiveled to machine surfaces to any desired angle. The work is fed by hand across the path of the tool.

*Fig. 21. Several Jig Boring Machines are Used for the Many Operations of Extreme Accuracy Required on Military Instruments*

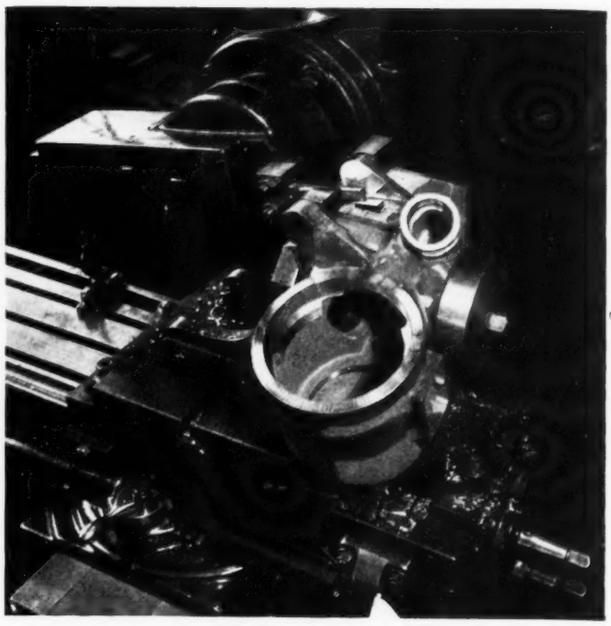


*Fig. 22. The Machining of Angular Surfaces on Some Complicated Parts is Performed on Milling Machines Equipped with Slotting Attachments*

* * *

## Exports of Industrial Machinery Continue to Increase

According to a report issued by Lewis Lind, chief of the Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., the exports of industrial machinery from the United States during October, 1939, the last month for which complete statistics are available, aggregated close to $24,000,000, an increase of 15 per cent, as compared with October, 1938, and about $700,000 more than the value for September, 1939. These gains were not brought about by the war in Europe, since recent orders have not yet been shipped.

Owing to increased shipments of most types of machine tools, the exports of power-driven metalworking machinery showed a 21 per cent gain over October, 1938, the figure for October, 1939, being $9,121,000. In this figure were included lathes, $1,646,000; vertical boring mills and chucking machines, $315,000; thread cutting and automatic screw machines, $523,500; milling machines, $650,000; gear-cutting machines, $505,000; and cylindrical grinding machines, $430,500.

# Changing from Welded to Cast Frame Construction in Press Design

By E. V. CRANE
Research Engineer
E. W. Bliss Co.
Brooklyn, N. Y.

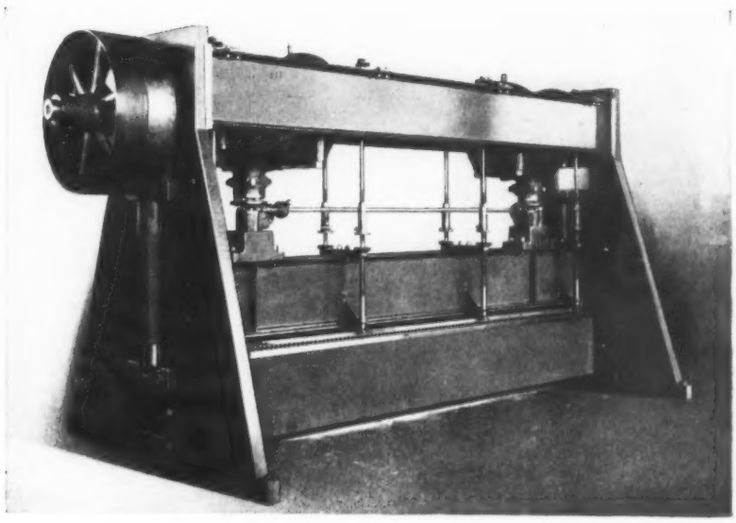


Fig. 1. One of Four Bliss High-speed Presses Constructed from Welded Rolled-steel Plate. These Presses Revealed Lack of Vibration-dampening Properties at 600 Strokes per Minute

A REVIEW of the history of the tendencies in design as applied to the construction of heavy-duty machinery of all types reveals a slowly but definitely changing curve, beginning with the exclusive use of cast iron as a frame material, passing through a gradual but extensive change to rolled-steel welded assemblies, and leading back to a reasonable conception of the proper place for both iron castings and welded fabrication.

It was but a short time ago that rather bitter controversies were waged on this subject, the advocates on both sides making strenuous efforts to establish their opinion as to the all-inclusive advantages of their particular type of construction. Today, however, a more rational view prevails, and designers are better acquainted with both the advantages and the limitations of cast iron, as well as welded steel. To a great extent credit for this more satisfactory state of affairs is due to two things—the metallurgical advance made in the production of cast irons, and the accumulation of experience with the application of welded assemblies to heavy-duty machinery.

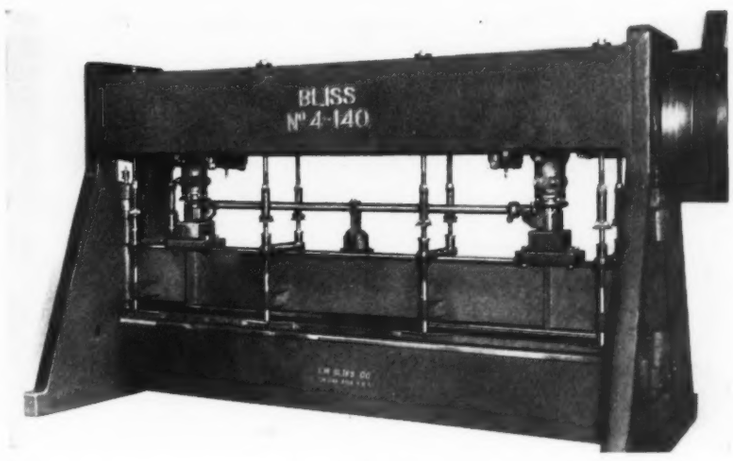



Fig. 2. One of the Presses Later Designed for the Same Service as the Type Shown in Fig. 1, but Made Mainly from Modern Iron Castings

### *Advance in the Metallurgy of Cast Iron*

With reference to the application of cast iron to heavy-duty press design, for example, it was customary at one time to figure with a maximum tensile strength of 30,000 pounds per square inch as a basis. Today high-duty cast irons are available with tensile strengths up to 60,000 pounds per square inch. This fact permits the designer to obtain the same strength with only half the weight of cast iron. This improvement in cast iron has created entirely new standards of engineering design, as well as of economy.

In the present article, the experience of the E. W. Bliss Co., Brooklyn, N. Y., builders of presses, will be recorded. This company has made direct comparative studies of the manufacturing economies and performance record of two identical presses built for the same purpose, one press being built by welded assembly (Fig. 1) and the other from iron castings (Fig. 2). These double crank presses are known as Bliss No. 4-140. Both

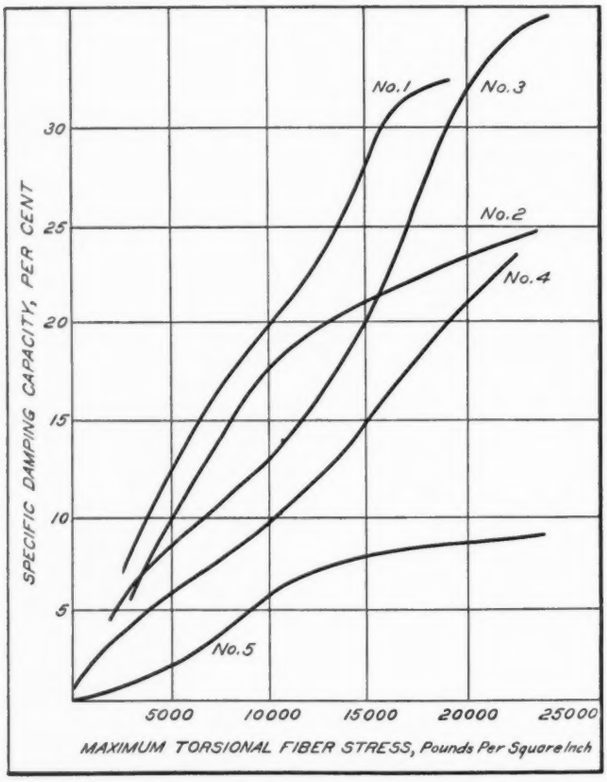



Fig. 3. Vibration Damping Tests Reveal Relationship between Tensile Strength and Damping Capacity of High-grade Cast Iron and Steel. Curve No. 1, 33,300 Pounds Tensile Strength Meehanite; No. 2, 36,100 Pounds Tensile Strength Meehanite; No. 3, 47,350 Pounds Tensile Strength Meehanite; No. 4, 57,000 Pounds Tensile Strength Meehanite; and No. 5, 0.23 Per Cent Carbon Steel. (Courtesy of Meehanite Research Institute)

presses were used in the same plant at the same time. On the basis of this and other experiments with machines of this type, the Bliss company has come to the conclusion that, in the fabrication of heavy presses whose successful and enduring operation is dependent upon rigidity of construction, iron castings possessing the required engineering properties will meet the requirements better than any other commercial material.

The cost figures of the Bliss company reveal that, while approximately the same weight was used in both cases for purposes of mechanical balance under high-speed operating conditions, the cast-iron construction cost, in total, $800 less than the welded construction. Over a period of time in operation, the cast-frame press was judged to give more satisfactory performance—in this case due to the vibration damping properties of the finely divided free graphite in the iron, as recorded in Fig. 3. This vibration damping or shock absorbing property of good cast iron is a vital necessity in punch press construction, since machines of this type are repeatedly subjected to shock loads and sudden release of accumulated loads.

The experiments conducted by the E. W. Bliss Co. indicated that the plasticity of steel, which adapts steel so admirably to the severe plastic working operations of the stamping industry, and which is also used to advantage in bridge construction and for a hundred and one other purposes, is not an advantage in press frame construction.

Engineers, the Bliss company holds, should design from the standpoint of elastic properties and yield point of materials. The discussions of cast iron as compared with welded fabrication have revolved mostly around the tensile properties of steel, and have not taken sufficient cognizance of the weld metal and the effects of welding on the steel itself. Experiments show that the relationship of the elastic limit and yield point of a high-duty cast iron and weld metal is as follows:

| | True Elastic Limit, Pounds per Square Inch | Yield Point, Pounds per Square Inch | Tensile Strength, Pounds per Square Inch |
|---|---|---|---|
| High-duty Cast Iron (such as Meehanite) | 17,000 | 45,000 | 55,000 |
| Weld Metal ..... | 16,200 | 35,200 | 56,500 |

These figures reveal that the elastic properties of high-grade cast iron are comparable with those of ordinary welded steel. Whatever may be the facts relating to a welded joint made under ideal conditions and by experienced and conscientious welders, evidence of the reduction of steel plate properties after welding cannot be ignored. Recently, in the course of a law suit relating to some weld failures, test pieces were cut from the material at the weld and similar pieces from new plates. These pieces were submitted to impact tests. The steel plate, before welding, proved capable of withstanding several times the number of blows that the pieces withstood at the weld.

Figs. 4 and 5 show a Marquette No. 632 press, manufactured by the E. W. Bliss Co., and a Bliss No. 306 press, the latter being constructed from cast iron and the former from welded plates. These presses each have a 6-inch crankshaft, are of single gear construction, and are designed for the same tonnage rating. The welded steel plate press weighs 3440 pounds less than the iron press, but it cost $183 more to build. The welded press is of a carefully worked out design and is giving satisfactory performance; yet experience shows that welded frames are not necessarily cheaper if design principles based on the functions and service requirements of the machine are carefully adhered to.

### *Tensile and Compressive Stresses are of Equal Importance in Press Frame Design*

Perhaps one of the fundamental points to be considered in designating the proper place for welded and cast-iron construction is the fact that, in operation, the members of heavy-duty presses are subject to bending strains in which tensile and compressive factors are equally important. Actual-

ly, only the tie-rods are in straight tension and these, of course, are made from relatively soft and plastic steel. The other members are beam members, in which the stresses are divided between tension and compression.

The criterion of strength, therefore, should be the average of the tensile and compressive strengths of the material to be used. In compression, iron castings show a much higher strength than steel plate, and modern cast irons are not a great deal inferior in tensile strength. For example, Meehanite cast iron, now widely used for press frames, has regularly a tensile strength of more than 50,000 pounds per square inch, with a compressive strength of 165,000 pounds per square inch. A.S.T.M. No. A-10-34 steel has an average tensile and compressive strength of 60,000 pounds per square inch. The average of the two values in cast iron indicates that it is permissible to use less metal in cast construction than in plate construction for the purpose mentioned, especially since the proper use of castings lends itself to careful distribution of weight throughout the structure.

The preceding paragraphs should not be understood to mean that there is no place for welded assembly in the manufacture of heavy-duty machinery; unquestionably there is a place for welding in the manufacture of certain types of such equipment. However, that place has definite boundaries, created by accepted design principles. Press design, in particular, requires maximum stiffness for die life and a safe margin below the elastic limit at which the construction metal takes a permanent set. Modern casting practice, as exemplified by Meehanite castings, provides freedom from concealed defects and a close-grained matrix dispersed with finely divided graphite. These qualities recommend it for use where rigidity, resistance to fatigue, impact, and adequate compression strength, as well as tensile strength, are required.

* * *

## Duke University Organizes College of Engineering

The Division of Engineering at Duke University, Durham, N. C., which has formerly been part of Trinity College, has been reorganized as a separate College of Engineering, with W. H. Hall, professor of civil engineering, as dean. Courses in civil, electrical, and mechanical engineering will be given. The enrollment in the engineering courses is now 216.

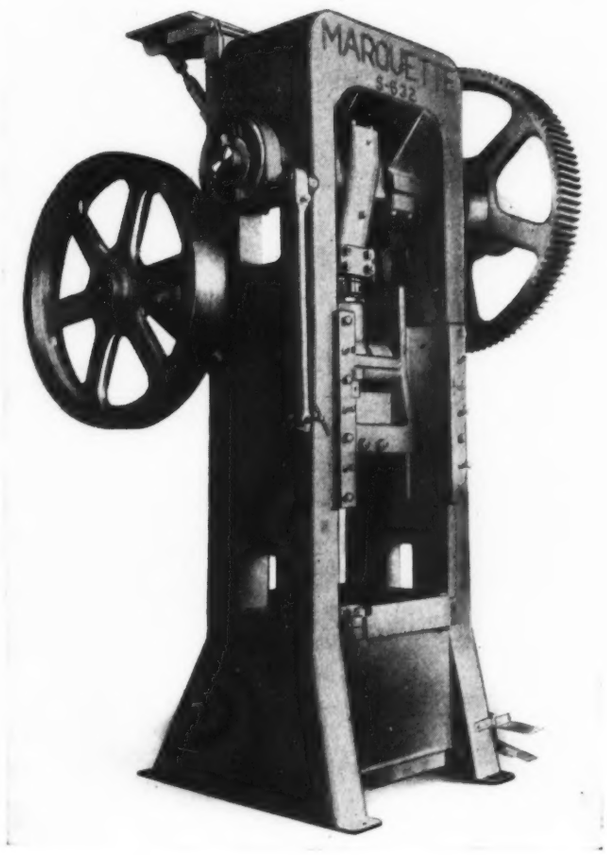



Fig. 4. Bliss-Marquette Welded-steel Plate Frame Press with 6-inch Crankshaft and Single-gear Construction. It Weighs Less, but Costs More to Build, than the Press Illustrated in Fig. 5

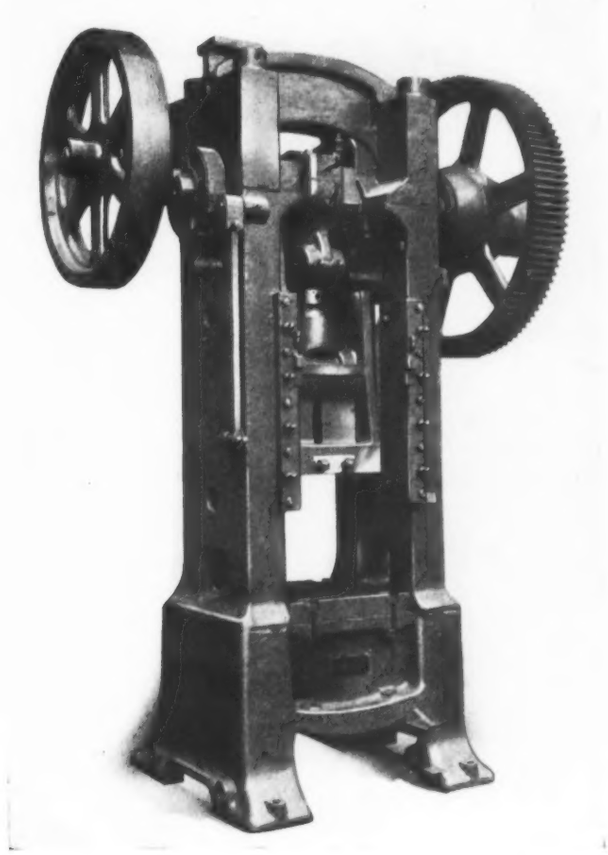


Fig. 5. Similar Bliss Press Using Plastic Steel for Tie-rods, but Modern Iron Castings for Beam Members, thus Securing the Advantage of High Compressive Strength and Surface Hardness

# Careful Analysis of Proposed Products

## An Outline of the Procedure Followed in Planning for Quantity Production of Johnson Semi-Automatic High-Powered Rifles

Fig. 1. Two Models of the Johnson Semi-automatic Rifle. All Parts of the Upper Rifle were Made to the Closest Tolerances Specified on Working Drawings, and All Parts of the Lower Rifle to the Widest Tolerances Specified

INVENTION of a device is only the first step in making it a practicality. Successful marketing of the article generally necessitates refinements in the design to permit economical manufacture, and refinements for this purpose often bring important improvements in the functioning and appearance of the device.

Economical manufacture usually requires a preliminary careful analysis of the invention to determine the preferable methods of production and the proper dimensional tolerances of working parts. Without this preliminary analysis, tolerances closer than necessary may be specified, with a resultant high production cost. On the other hand, it may be learned, after fixtures, jigs, and other special equipment have been provided, that the tolerances are too wide to insure satisfactory functioning of the product and that this condition can be remedied only by extensive changes in the manufacturing routine. It may also be learned, after it is too late, that slight modifications in the original design would have permitted much simpler manufacturing practices than those adopted. If the proposed device is at all complicated, the expenditure of funds in a preliminary study of manufacturing procedure will be well repaid.

Melvin Maynard Johnson, Jr., (Captain, U. S. Marine Corps Reserve) the inventor of a semi-automatic short-recoil high-powered rifle which shoots ten bullets in rapid succession with one loading, and which has established sensational performance records both in this country and abroad, fully understood the fundamental principles here outlined, and brought his original rifle models to the Taft-Peirce Mfg. Co. for complete planning of a manufacturing program. It was decided to develop methods based on the production of fifty rifles a day, which would be applicable in the average well equipped machine shop, so that in case of an emergency, a large number of shops could be placed in production on rifle parts with little delay.

Of prime importance was another requirement believed to be unique in rifle manufacture—that the methods decided upon must insure 100 per cent interchangeability of all parts, so as to completely eliminate hand fitting in assembly operations. In other words, the job was to be "engineered" from the standpoint of an average machine shop.

The first step taken by the Taft-Peirce Mfg. Co. was to make a complete set of pencil detail and assembly drawings on bond paper of all parts, with the exception of the barrel, as the rifle is designed

# Simplifies Interchangeable Manufacture

By C. B. GARDINER, Assistant Secretary
Taft-Peirce Mfg. Co., Woonsocket, R. I.

to use either Springfield, Remington, or Winchester barrels of 0.27 or 0.30 caliber. In making these drawings, the tolerances specified were as wide as possible consistent with good workmanship, in order to keep down manufacturing costs and facilitate assembly, but close enough to insure rifles of high quality. A few tolerances on the receiver were as close as plus or minus 0.001 inch, and others as close as plus or minus 0.003 inch, but the tolerances on most dimensions were between plus or minus 0.005 inch and plus or minus 0.010 inch. In establishing these tolerances, good machine shop practice was followed, and it was constantly kept in mind that each extra zero after a decimal point would mean a more expensive gun.

Concurrently with the making of the pencil drawings, manufacturing processes were planned and a study was made of all machine tools, jigs, fixtures, special tools, working and inspection gages, etc., required for manufacturing parts on the basis of fifty rifles per day. More than 500 operation sheets were drawn up listing all details of operations. These sheets show sketches of the work, list the machines and tooling to be used, and indicate the cuts to be taken by each tool. Feeds and speeds are given, as well as the estimated time for each operation. Fifty-five different types of standard machines are necessary, and for a production of fifty rifles a day, 174 standard machines are used. Incidentally, the receiver, which is the most difficult part, must undergo 123 machining operations.

Upon the completion of these preliminary steps in planning the manufacturing methods, three rifles were made to prove the correctness of the drawings. One of the rifles was made to all of the dimensional high limits, another to all the low limits, and a third to the median limits. Only in this way could it be definitely determined before actual manufacture was started that a gun made to the closest fits or to the widest fits would function to complete satisfaction.

All parts for these models were made in the tool-room and checked in a constant-temperature room to insure accuracy of dimensions. It was extremely gratifying that these rifles met the most severe tests satisfactorily. They prove the practicability of the specified tolerances and the planned manufacturing procedure. Whereas few of the

Fig. 2. Simplicity is One of the Features of the Johnson Semi-automatic Rifle; it can be Disassembled, as Shown, and Reassembled Ready for Use in Two Minutes

parts on the original model made by the inventor were susceptible of production by ordinary machine shop methods, every part on the "engineered" rifle can be made by such methods. In addition, the "engineered" rifle is stronger than the original model; considerably simpler, and has a neater appearance.

All together, there are 103 parts to the rifle, including every piece made on a machine, such as small pins used for assembly purposes. The simplicity of the rifle has greatly impressed arms experts, as it is possible to change rifle barrels in a few seconds and to disassemble a rifle completely, as shown in Fig. 2, and reassemble it ready for firing in two minutes. The weight of the rifle is about 9 pounds. It has the accuracy and power of the well-known Springfield rifle.

A quantity of rifles have now been manufactured according to the methods developed in the study here described, and it is of interest to note typical performance records of some of these guns in impartial tests conducted by different persons in various places. They have been subjected to the most severe conditions, including excessively extended firing and operation with defective ammunition, abnormally loose barrels and intentionally careless assembly. One rifle, for example, fired 300 rounds of wartime ammunition without a single failure. Another fired 247 consecutive rounds of excessively soft brass-cased ammunition. In a rather spectacular performance, a third rifle fired 2400 consecutive rounds of ammunition in 1 1/2 hours at the rate of from 30 to 100 shots per minute after the mechanism has been previously fouled by firing 500 rounds of ammunition. During this entire performance, there was no cleaning, oiling, or cooling of the weapon.

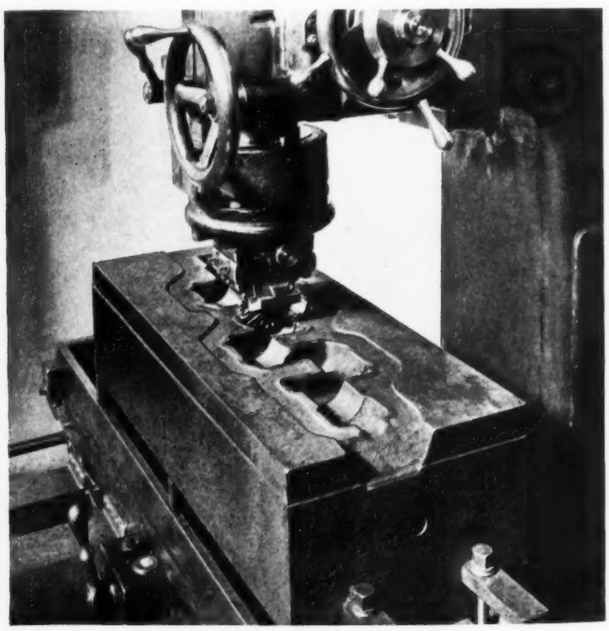
The work of "engineering" this rifle, including the making of all drawings, operation sheets, and the model rifles, took less than a year, a creditable performance, considering the work involved.

* * *

## Insulating Joints for Pipe Lines in Plating Shops

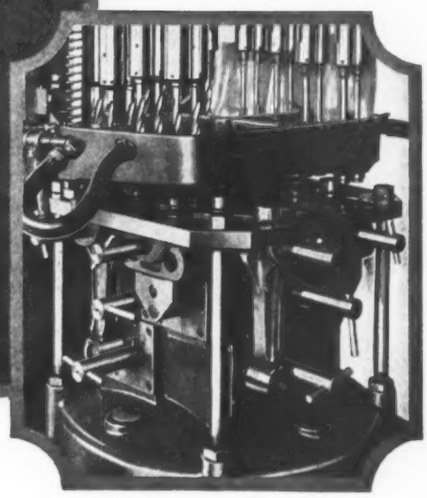
Plants employing electrochemical processes, such as electroplating shops, must constantly meet the problem of the possibility of electrical grounds through the pipe lines transmitting the chemical solutions. To eliminate this danger, the best practice is to use insulating joints in the lines. The Hanson-VanWinkle-Munning Co., Matawan, N. J., has brought out a line of joints having compressed fiber insulating rings which encircle the ball member at two different places.

The joints are tested for 125 volts direct-current service and for 200 pounds per square inch steam pressure. They can be used under hydraulic pressures up to 1000 pounds, depending upon the size of the joint. These joints are suitable for cleaning tanks, plating tanks, and heating and cooling lines.



(Above) Finishing the Impressions in a Die-block for Crankshafts with a Cherrying Attachment on a Reed-Prentice No. 5 Vertical Miller and Die-sinker. (Left) Using a Reed-Prentice Jig Borer to Accurately Locate and Finish a Number of Bores in a Fixture

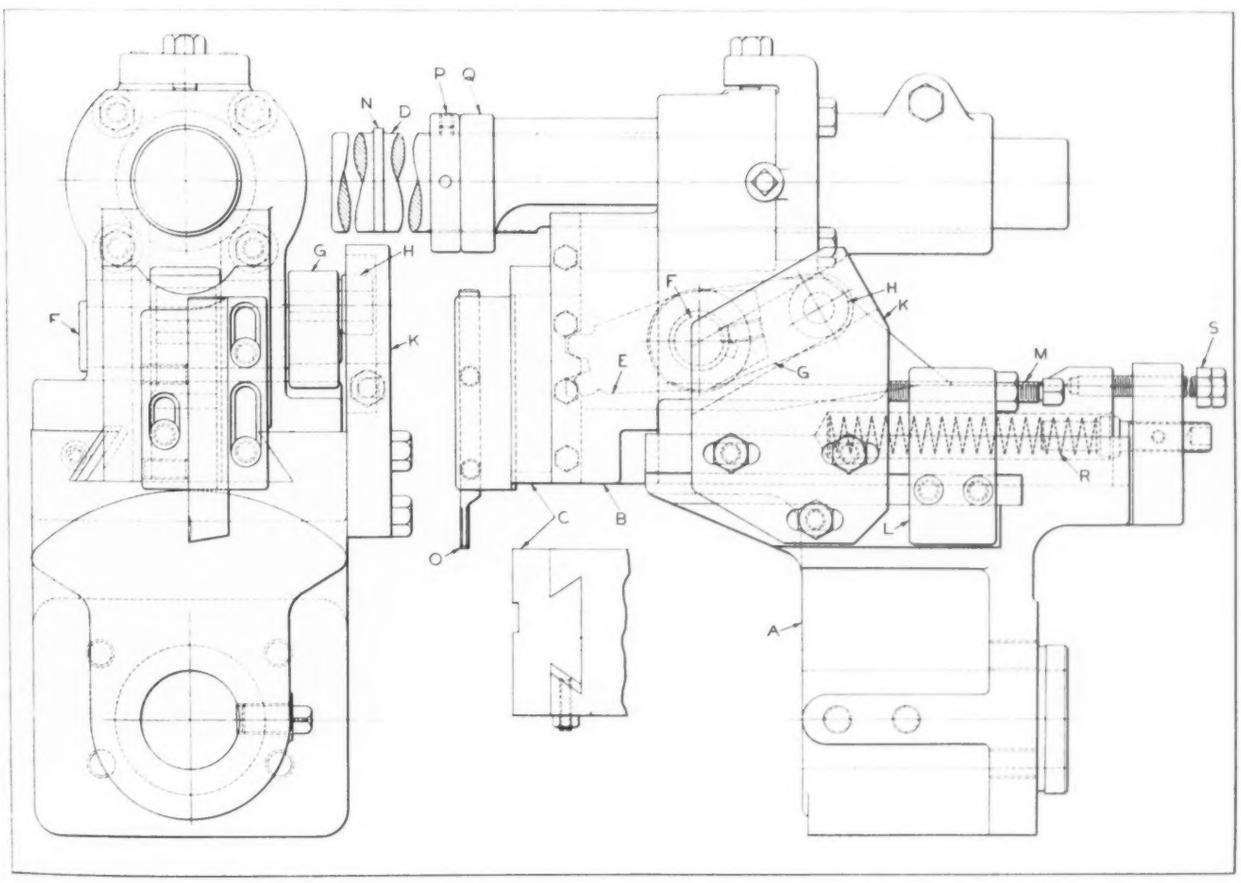
# Design of Tools and Fixtures



## Cutting-Off Tool for Use with a Hexagon Turret

By I. F. YEOMAN, Elkhart, Ind.

The accompanying illustration shows a cutting-off tool that was designed for mounting on a hexagon turret of an automatic chucking machine. This tool was used for cutting off the finished part from a ring that was cast integral to provide a surface for gripping with the jaws of an air chuck. On this job, all the available space on the cross-slides was occupied with the tooling necessary for the operations preceding the cutting-off operation; also, it was impossible to combine the latter operation with any preceding one. This tool can be used




Cutting-off Tool Designed for Mounting on Hexagon Turret of Automatic Chucking Machine

on any type of turret lathe having a hexagon turret with power feeding movements; it can also be used for purposes other than cutting off.

The tool consists of the body *A*, which is flanged so that it can be attached to the face of the hexagon turret. The body has a dovetailed groove in it which receives the carrier-slide *B*. Slide *B* carries the overhead pilot-bar *D*. On the outer end of the carrier-slide, a sliding head *C* is attached by means of the dovetailed surfaces, which permits vertical movement of the sliding head and cutter. Attached to the back of the cutter-slide is a coarse-pitched rack meshing with the gear segment *E*, which is secured to shaft *F*; lever *G* is also secured to this shaft. Roller *H* is carried on a pin pressed into the end of lever *G*, and rides in the angular slot in cam *K*. This cam is attached to tool body *A*, and has a sensitive longitudinal adjustment through screw *M*, which is carried in block *L*.

The action of the cutting tool is as follows: When the turret feeds the tool forward, overhead pilot-bar *D* enters a bushing that is rigidly attached to the head of the machine by means of a bracket. When shoulder *N* comes in contact with the face of the bushing, further longitudinal movement of the bar and carrier-slide *B* is stopped and cutter *O* is in the operating position. This position is predetermined through adjusting collars *P* and *Q*.

Continuation of the forward feeding movement of the hexagon turret moves tool body *A* along carrier-slide *B*. Cam *K*, attached to the tool body, also moves forward, raising roll *H*. The rise of roll *H* and lever *G* imparts, through shaft *F*, a swinging action to gear segment *E*. The gear segment meshes with the rack attached to the cutter-slide, which, in turn, gives a vertical movement to the cutting tool for the cutting-off operation.

As the tool body feeds forward for the cutting-off operation, spring *R* is compressed, thus providing the medium for returning all the sliding members of the tool to the starting position when the hexagon turret backs clear of the work for indexing to the next station. The return movement effected by spring *R* is stopped by means of the sliding stud and check-nuts *S*.

This tool was designed by the Foster Machine Co. of Elkhart, Ind., for use on the Fastermatic.

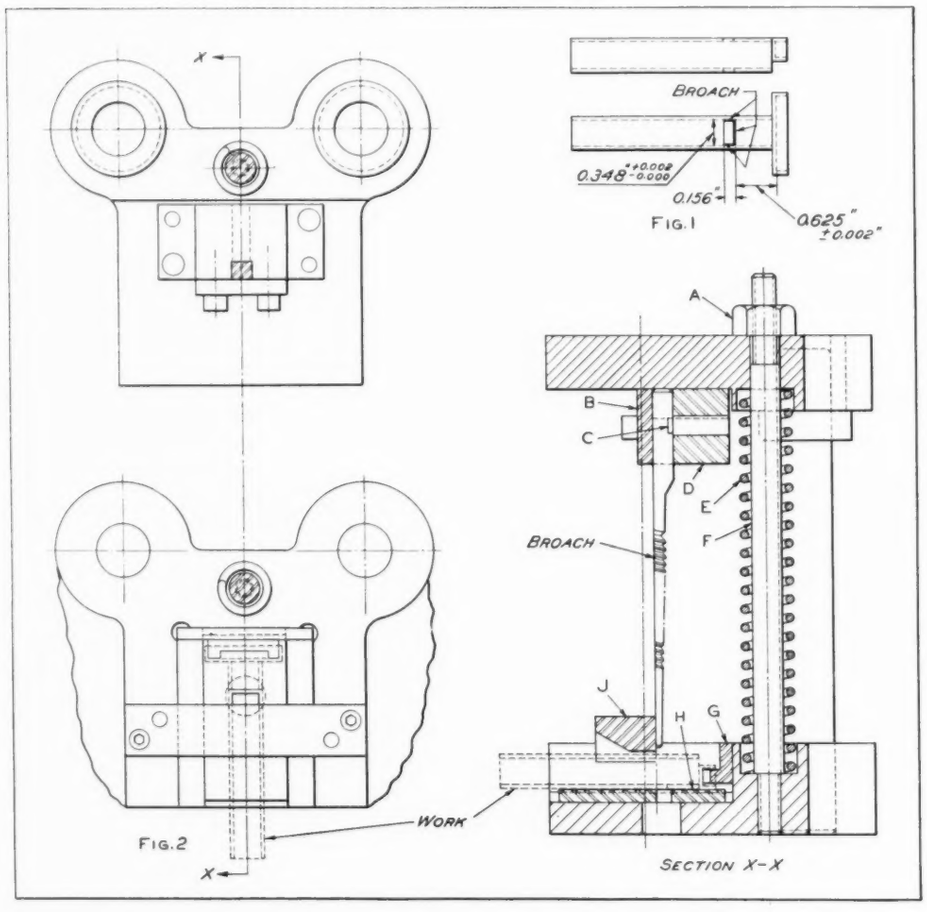
## Arbor Press Broaching Fixture

By EARLE B. WILSON, Toledo, Ohio

Three sides of a rectangular slot in a die-casting, as indicated by heavy lines in Fig. 1, were required to be broached to close tolerances, as specified. Since the production was only a few thousand pieces per week, the cost of the tools had to be kept as low as possible.

Ordinarily, this job would have been done in a punch press, but it was found that the required shut height was greater than that of any available press. Consequently the fixture shown in Fig. 2 was designed for use in a hand-operated arbor press. The lever of the press was removed and replaced by a suitable handwheel.

A standard die set was used. To the punch-holder was attached the broach adapter consisting of members *B*, *C*, and *D*. Pin *C* acts as a key to keep the broach from being pulled out. Part *B* clamps the broach in place and facilitates its removal. A gage *G* locates the work properly on the hardened supporting plate *H*. The hardened stripper *J* also serves to back up the




Broaching Fixture Designed for Use in Arbor Press

broach. The spring *E* is heavy enough to support the weight of the moving parts and the ram of the arbor press. A nut *A* on the end of rod *F* limits the upward movement of the broach. A suitable adapter (not shown) is fastened to the punch-holder for attaching it to the press ram. The broach is of conventional design. The last three teeth are burnishers and enlarge the slot slightly, so as to avoid dragging of the cutting teeth on the upward stroke.

## Angle-Gage for Screw Machine Work

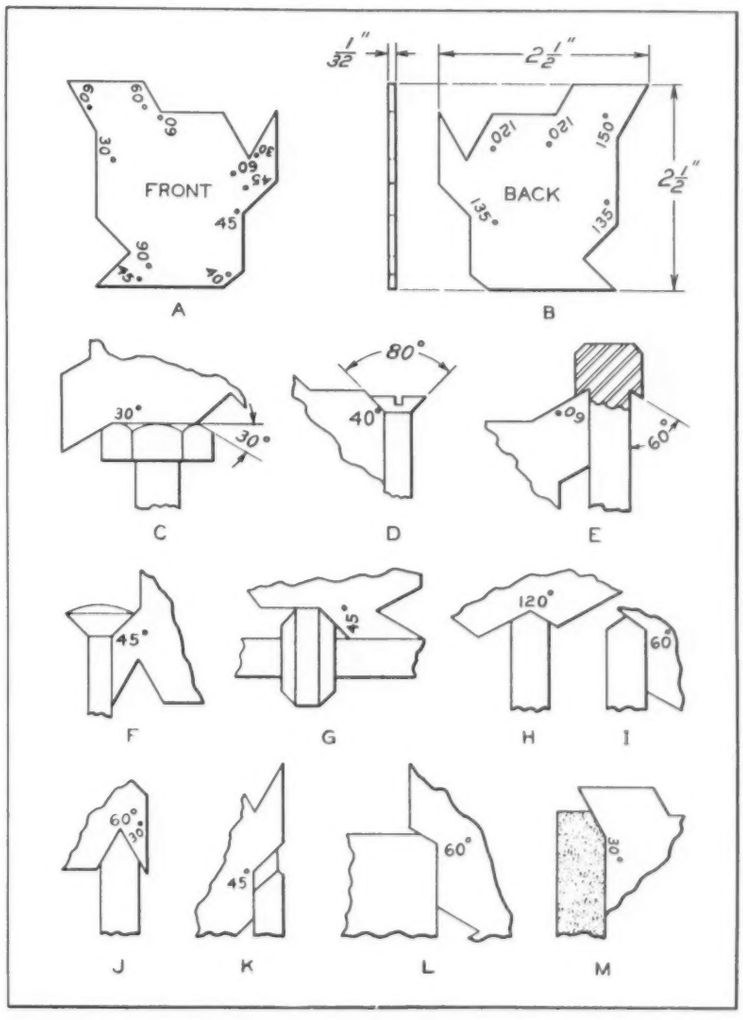
By ROBERT E. HULSE, Mechanical Inspector
General Electric Co., Schenectady, N. Y.

The angle-gage shown at *A* and *B* in the accompanying illustration was developed by the writer to save time and eliminate the necessity for making individual gages for the many screw machine parts that come to him for inspection. Incorporated in this gage are the angles most commonly used between 30 and 90 degrees and their supplements. The gage is so designed that it has a parallel face opposite each angle to facilitate its use in setting up work.

The gage shown was filed from a piece of B & S flat stock 1/32 inch thick by 2 1/2 inches square. It can, of course, be made larger or smaller to suit requirements. This gage has become quite popular among the operators of both hand and automatic screw machines, set-up men, and toolmakers, who use it in dressing down emery wheels for grinding chasers, forming tools, etc., and wherever it would be awkward to use a protractor.

The view at *C* shows the method of using the gage to check the angle of the chamfer on a bolt or a cap-screw head, rivet heads, etc. At *D* is shown the method of checking the 40-degree angle on the countersunk head of a screw or rivet. At *E* the gage is shown in position for checking a 60-degree under-cut.

The checking of a 45-degree angle on the head of a staybolt is shown at *F*. Heads with angles of 40 and 60 degrees can also be checked in a similar manner. At *G* the gage is shown in position for testing the angular surface of a collar or flange. Included angles of 60, 90, 120, 135, and 150 degrees can be tested with the gage in the manner indicated at *H*. Acute angles of 30, 45, and 60 degrees are tested as shown at *I*. The angles to which threading and grooving tools are ground can be checked in the manner indicated at *J* and *K*. The lead of thread chasers can be tested as shown at *L*. Acute angles of 30, 45, and 60 degrees can be gaged when dressing grinding wheels for forming tools in the manner indicated at *M*.




Angle-gage and Diagrams Showing Typical Applications

## Piercing Die with a Special Stripping Device

By JOHN J. McHENRY, Detroit, Mich.

The punch and die shown in the illustration (see next page) was made to pierce the two holes in the shell shown in Fig. 3. The die construction is self-explanatory except, perhaps, for the angular plug shown at *X*. This plug was forced into the center hole of the die to deflect the pierced slugs and prevent them from packing up against the wall of the die.

Of special interest is the stripping device. This consists of springs *D*, hold-down plate *A*, compression spring *B*, and stripper fingers *C*. Stripper fingers *C* are 1/4 inch thick, and are held in place by pins passing through the 1/4-inch slot in the

hold-down plate. It will be noted that the finger assembly is not on the center line of the die, but is located closer to the front of the die, the purpose being to allow the shell, when stripped, to fall more easily to the back of the inclined press.

Assuming that the shell has been placed in position to be pierced, the press is tripped, and on the down stroke of the ram, fingers *C* pass over the shell, compressing spring *B;* when the fingers have passed below the shell skirt, they are opened through the action of spring *B*. Next, compression plate *A* comes into contact with the top of the shell, and holds the shell firmly in place. As the down stroke continues, the pressure plate springs *D* are compressed and the piercing takes place. On the up stroke of the press, the piercing punches withdraw, the compression plate then moves upward, and the stripper fingers *C* remove the shell. The stripper fingers are so shaped that they clear the shell skirt, thus allowing the shell to fall freely to the back of the inclined press.

* * *

The Elmira Chapter of the American Society of Tool Engineers will hold its next meeting on January 12 at the Hotel Langwell, Elmira, N. Y., at which time F. W. Warner of the Plastics Division of the General Electric Co. will be the principal speaker, covering a subject of unusual timeliness.

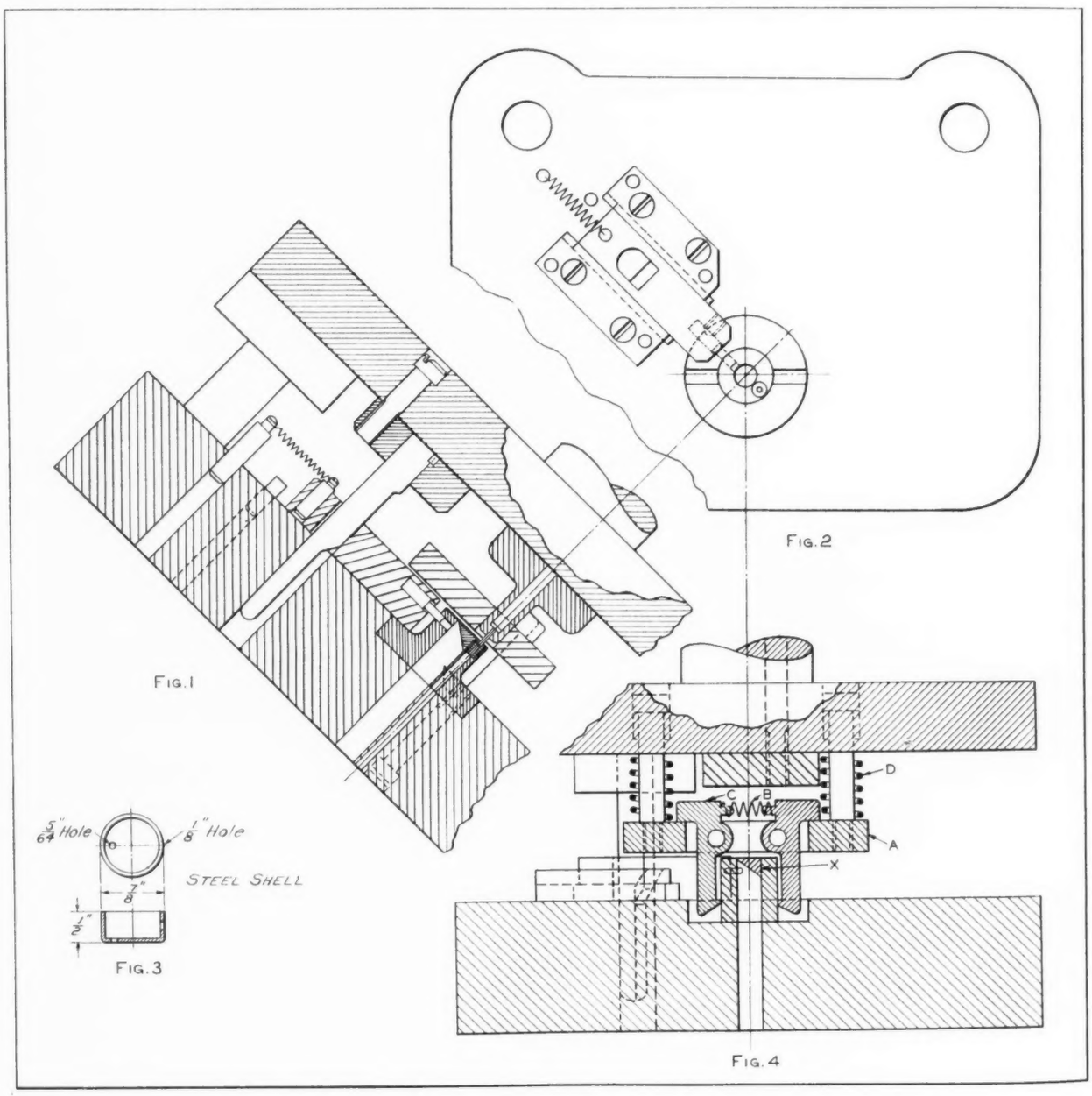
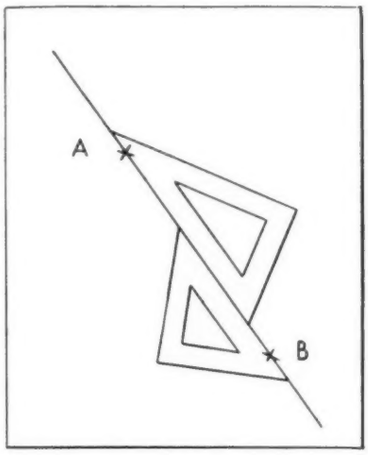



Fig. 1. Cross-section through Punches that Pierce the Holes in Shell Shown in Fig. 3.
Fig. 2. Plan View of Piercing Die. Fig. 3. Shell with Holes Pierced in Side and Top.
Fig. 4. Cross-section through Stripper and Hold-down Plate

# Ideas for the Shop and Drafting-Room

**Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work**

## Simple Method of Drawing a Long Line




Method of Using Two Triangles in Drawing Lines between Distant Points A and B

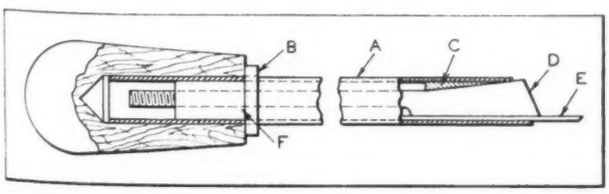
Many draftsmen who use the sides of two triangles to draw long continuous lines or a line between two points *A* and *B* will find it more practical to use the long side of the triangles, as shown. Before drawing the lines, the sides of the triangles should be checked for accuracy.

PAUL GRODZINSKI
Sutton, Surrey, England

## Inserted-Blade Scraper for Catalin or Wood

The scraper-blade holder here illustrated was devised by the writer for use in making novelty lamps and other small articles from Catalin. This holder has proved serviceable, as well as economical. Short pieces of steel shaped to any desired contour can be firmly secured in the end of the holder.

The holder proper is made of a short length of square brass tubing *A* with a flange *B* brazed to it near one end and a wedge of steel *C* riveted and brazed inside the opposite end. A steel draw-rod *D* having a wedge-shaped end, which passes through the tube, provides means for clamping the steel scraper *E* in place. The handle is fitted with a nut *F* for obtaining the lateral movement of draw-rod *D* required for clamping the scraper blade *E*. A slight turn of the handle quickly releases or locks the blade in position.

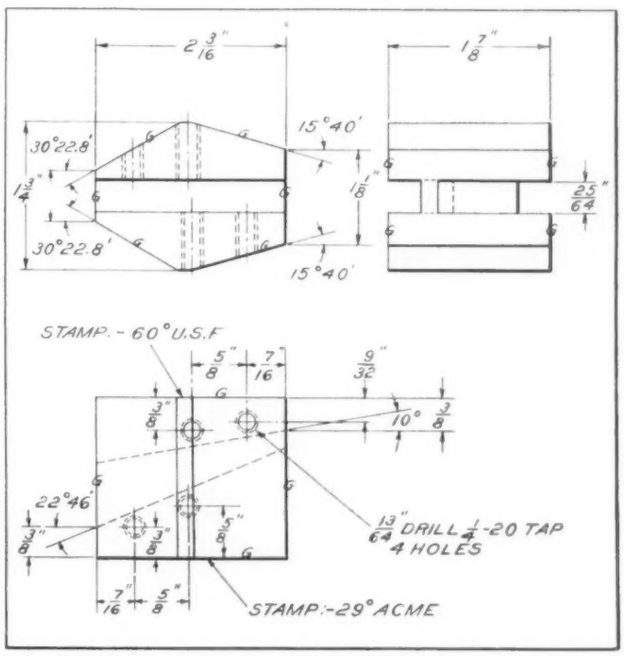



Scraper with Inserted Blade E for Use on Catalin or Wood

Toronto, Canada JAMES H. RODGERS

## Threading Tool Grinding Block

Our threading tool holder bits are kept in condition for cutting accurately formed threads by using tool grinding blocks like the one shown in the illustration. The bits are held in the slots in the blocks and are sharpened by alternately grinding the sides and end at one setting. The sharpening is done on a surface grinder, the blocks holding the tools being held on the magnetic chuck of the machine.




Tool Bit Holding Block Used on Magnetic Chuck for Sharpening Threading Tools

The angles to which the sides of the blocks are machined were computed to give an angular clearance of approximately 5 1/2 degrees on the sides of 60-degree tools, and 6 degrees on the sides of 29-degree Acme thread bits. These clearance angles have been figured for threads up to four per inch on 1-inch diameter pieces, so that there will be no side interference when cutting either left- or right-hand 60- and 29-degree threads.

New Britain, Conn. WILLIAM C. BETZ

# Welded Tubular Frame Solves Heavy Machine Construction Problem

**Lighter Construction, with Greater Rigidity, and a Reduction in Building Time are Important Advantages Gained by Redesigning the Frame of a Pipe-Bending Machine**

By E. WALTERS
Wilson Welder & Metals Co., Inc.
New York City

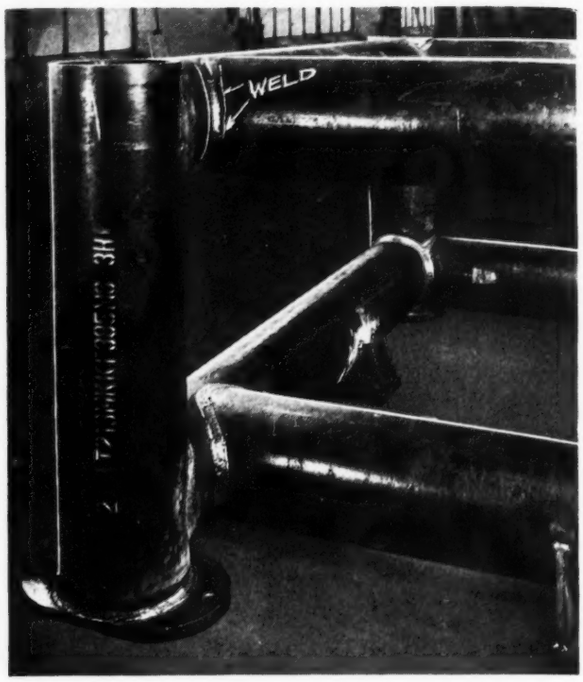



Fig. 1. Typical Welded Joints in Tubular Frame Constructed for Pipe-bending Machine Shown in Fig. 3

IN developing a large hydraulic rotary type tube- and pipe-bending machine, the Wallace Supplies Mfg. Co., Chicago, Ill., discovered that important advantages could be obtained by substituting tubular members for structural shapes in the construction of the frame. This change in construction was brought about when the company was offered a contract to build a machine with a capacity for bending 8-inch double extra heavy pipe, only sixty days being allowed for delivery.

The original design called for a frame built up of arc-welded steel plate and rolled structural shapes. The factory organization was thoroughly familiar with this type of construction, having used it for a long period in the fabrication of frames for an extensive line of tube and structural shape benders. With this construction, however, it was considered impossible to complete the machine in the time specified. The company then submitted a proposal to redesign the frame for welded tubular construction, which, they correctly estimated, would enable them to meet the delivery requirements by a reasonable margin, and at the same time would produce a machine having sufficient strength and rigidity to withstand maximum loading without flexure. The tubular frame was designed by E. J. DeWitt, vice-president and chief engineer of the company. The new design was approved, and the work on the first machine of this type started.

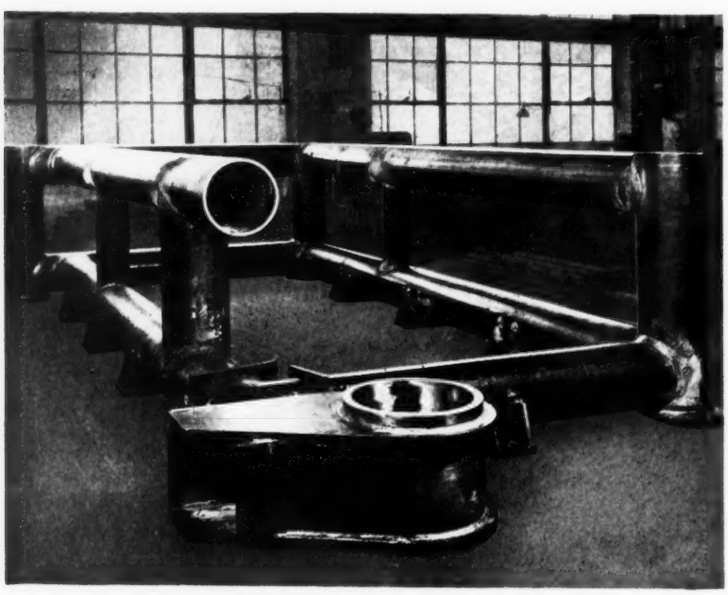


Fig. 2. Completed Main Frame Assembly of Welded Tubing for Pipe-bending Machine Illustrated in Fig. 3

The pipe bender is required, in effect, to perform a cold-drawing operation, producing the desired curvature in a piece of straight pipe with a slight stretching of the outer wall on the curve and compression of the inner wall material. Rigidity of the entire machine frame under operating conditions is an essential factor in producing smooth and accurately dimensioned

bends. For this reason, it was very gratifying to find that the finished machine showed a maximum deflection under load of 0.013 inch, as compared with a recorded deflection of 0.103 inch with the former structural design, although the weight had been reduced from 59,000 to 49,000 pounds in the new design.

Fig. 1 is a close-up view of the frame assembly, made up of 12-inch extra heavy steel pipe and heavy steel plate. All parts were cut to size and shape with oxy-acetylene cutting machines. This illustration shows how rigidity is gained by ample reinforcement at all connections. The plant welders were experienced in heavy-duty welding, and although the use of tubular members on large frames was entirely new, a moderate amount of special instruction enabled them to handle this assortment of pipe connections without difficulty.

As many as twenty-five beads were required on some of the joints; yet this did not make the welding costs excessive. On the contrary, the welding cost per pound of steel in the frame was somewhat less than when structural shapes were used throughout. This fact, combined with a 27 per cent reduction in weight, showed a substantial saving in this item. Further, the set-up time was 23 per cent less in the case of the redesigned frame.

The complete frame assembly is shown in Fig. 2. The legs attached to the base are fabricated from steel plate and are also of welded construction. The arc-welded bearing housing shown in the foreground was cut from steel plate, and welded inside and outside. When this unit is set in place, the open end of the pipe is inserted in the open box end of the bearing housing and welded in position.

With the working mechanism installed, the pipe bender has the trim and rugged appearance shown in Fig. 3. The main shaft is made of S A E-3140 steel and is finished all over. The bearing supports for the shaft are of forged steel, with rolled-steel stiffening members welded to the frame. Bending is performed by a drive cylinder, the return stroke operating at twice the speed of the bending stroke. The cylinders are designed to operate at a pressure of 1500 pounds per square inch, and are tested at 2000 pounds per square inch. Energy from the cylinder and pump unit is transmitted to the bending head by means of a rack and gear, which are also made of S A E-3140 steel.

The rack and gear are flame-cut from 10 1/2-inch slabs with the oxy-acetylene machine cutting torch, and are subsequently flame-hardened. The pressure slide is brought into position by means of a hydraulic cylinder operating through a toggle, and the bending pressure is controlled by a coarse-pitch screw. The mandrel units are adjustable and hydraulically operated. Three valves provide for the control of all the movements. An important feature of this machine is that it permits cold-bending of pipe and tubing up to an angle of 180 degrees in a single continuous operation without wrinkling the pipe.

* * *

## Machine Tool Exports to England, France, and Russia

During September, the first month of the war, exports of metal-working machinery from the United States to the United Kingdom and France amounted to about $5,400,000, an increase of more than $2,000,000 over the same shipments in September, 1938. The exports to France jumped from $500,000 in September, 1938, to $2,030,000 in September, 1939. The exports to the United Kingdom rose from $1,090,000 to $3,387,000. Sales to Canada rose from $334,00 to $612,000. On the other hand, exports to Russia declined sharply from $2,677,000 in September, 1938, to $377,000 in September, 1939. This sharp decline was probably due to the difficulty in making shipments to Soviet Russia.

* * *

## Correction

In an article published on page 275 of December MACHINERY, which described the stainless-steel bonded carbon-molybdenum plate brought out by The Babcock & Wilcox Co. for high-temperature service, credit was given to the plant of the concern at Beaver Falls, Pa. The article should have stated that the process was developed at the Barberton, Ohio, plant of The Babcock & Wilcox Co.

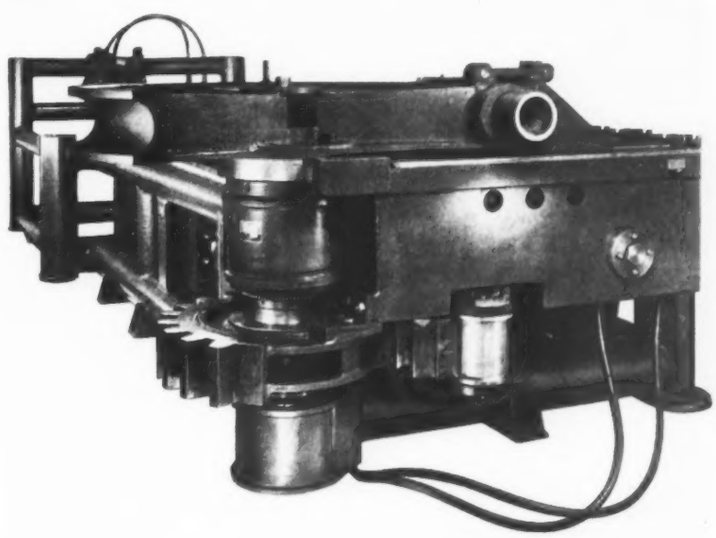


Fig. 3. Pipe- and Tube-bending Machine with Welded Tubing Frame and Oxy-acetylene Flame-cut and Flame-hardened Rack and Gear

## Lincoln Foundation Announces a $200,000 Award Program

The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, has announced a 2 1/2-year program of study of industrial progress which will culminate in the payment of $200,000 in awards. In all, 458 awards are offered for studies that will indicate how industrial progress can be furthered by improving the design, manufacture, fabrication, construction, and maintenance of all types of machines, buildings, structures, and industrial products by means of arc welding. The awards range from a grand award of $13,700 to 223 awards of $100 each, including one award each of $10,000, $7500, and $5000; 12 awards each of $3000, $2000, $1000, and $800; and 46 awards each of $700, $500, $250 and $150.

These awards are made for studies bringing out the benefits of a social, economic, or commercial nature, such as the reduction or elimination of hazards to safety and health, greater availability of comforts and conveniences through reduced prices, greater utility and durability of machines and structures, as well as industrial benefits, such as cost savings and manufacturing advantages. The improvements may pertain to practically all kinds of machines, products, and structures—automobiles, trucks, buses, airplanes, locomotives, railroad cars, street cars, ships, buildings, bridges, houses, furniture, heating, air-conditioning and refrigeration equipment, farm machinery, road-building equipment, and industrial machinery of every kind.

Participation in this program is open to everyone who plays any part in actually bringing about the development, construction or building of such equipment in an executive, design, fabrication, manufacture, construction, or maintenance activity. The authors of the treatises outlined in these studies may be general executives, engineers, designers, architects, draftsmen, plant superintendents, production managers, foremen, owners of garages, service stations, and repair shops, or any other person engaged in the phases of work outlined.

Authors may submit studies individually or as a group, and any company may submit more than one study, provided each is on a different subject and is prepared and submitted by a different author or group of authors. The studies must report progress that can be attributed to the application of the electric-arc process of welding within the 2 1/2-year period from January 1, 1940 to June 1, 1942.

## Drawing Isometric Circles

By J. S. BEGGS

The accompanying diagram and chart have been designed for use in drawing circles in isometric projection drawings without the usual construction lines. This saves considerable time, results in cleaner drawings, and reduces the largest element of expense in making isometric drawings. Circles in plan, elevation, and end views appear in isometric drawings as ellipses of constant eccentricity. These ellipses are made up approximately by a composite curve consisting of four circular arcs having eight points in common with the true ellipse.

If $c$, Fig. 1, is the radius of the circle to be drawn as an ellipse, $a$ and $b$ the semi-major and semi-minor axes of the ellipse, and $R$ and $r$ the radii of the arcs used to construct the approximate ellipse, then we have: $a = 1.225c$; $b = 0.7071c$; $R = 1.810c$; and $r = 0.4784c$.

The radius $a$ is also the same as the radius of an isometric sphere whose true radius is $c$. The values for $a$, $b$, $R$, and $r$ can be obtained from the chart, Fig. 2, by first locating the given value $c$ on the scale at the bottom of the chart and then following

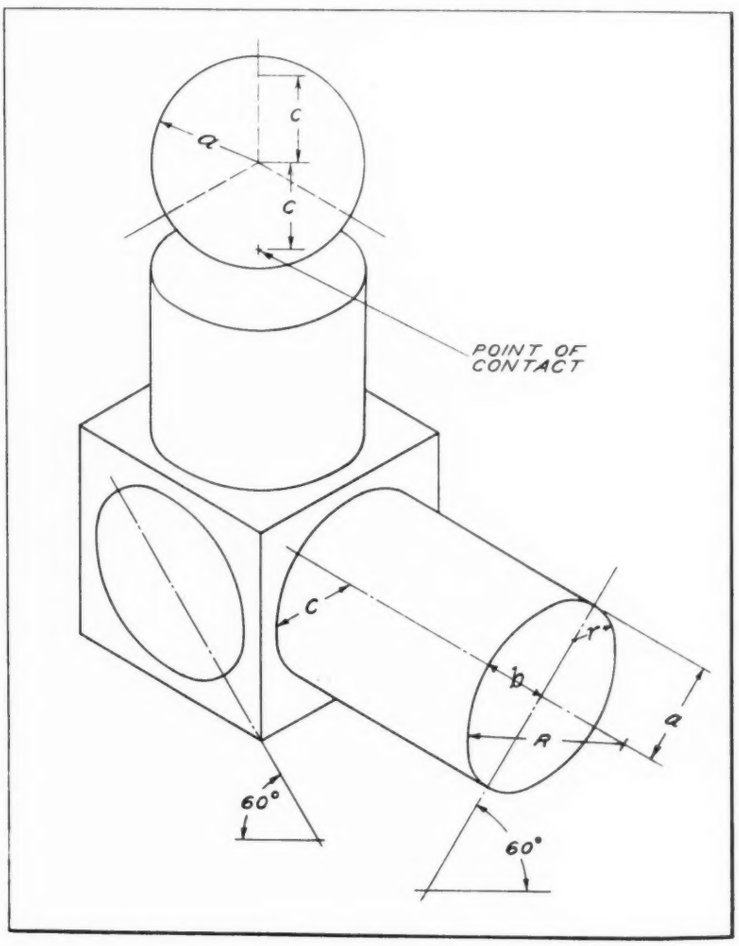



Fig. 1. Diagram Showing how Ellipses are Drawn to Represent Circles on Isometric Drawings

the vertical line from that point upward to the points where the vertical line intersects the diagonal lines representing $r$, $b$, $a$, and $R$, the values of which are found on the scale at the right-hand side of the chart by following horizontal lines from the points of intersection to the scale, as indicated by the dotted lines. For example, if $c$ equals 10, then we have $a$ equals 12.2, $b$ equals 7.1, $R$ equals 18.1, and $r$ equals 4.8, the tenth graduations being estimated on the scale shown. A larger chart can, of course, be made with finer graduations for more accurate readings.

As shown in Fig. 1, the major axis is drawn through the center, horizontally or at an angle of 60 degrees or 120 degrees, depending on the view of the object shown. The semi-major and semi-minor axes are laid off, after which the arcs are struck to give the approximate ellipse. It is suggested that anyone making a large number of isometric drawings, lay out a full-sized chart similar to the one shown in Fig. 2 on one-inch cross-section paper. The radii required in drawing an ellipse can then be taken directly from the chart with the compasses.

* * *

## Soviet Machine Tool Imports

The Soviet Union has recently placed orders for more than $50,000,000 worth of machine tools in Germany, according to a report of the Associated German Machinery Industries as recorded in *World Machinery News*, published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. It is assumed that these machine tools are to be delivered to Russia over a period of two years.

Until the recent economic agreements between Germany and Russia, the exports of German metal-working machinery to the Soviet Union since Hitler assumed power in 1933, have been considerably below previous levels. In the five-year period 1930 to 1934, the Soviet Union bought most of its machine tools in Germany, while from 1935 to 1939, the major part came from the United States, the shipments in 1938 amounting to $34,690,000, the high record of machine tool exports from the United States to the Soviet Union. From January, 1930, to June, 1939, inclusive, the United States, the United Kingdom, and Germany together furnished machine tools to a value of $313,000,000 to the Soviet Union. Of this, the United States' share was about $117,500,000; Germany's, $153,500,000; and the United Kingdom's, $42,000,000.

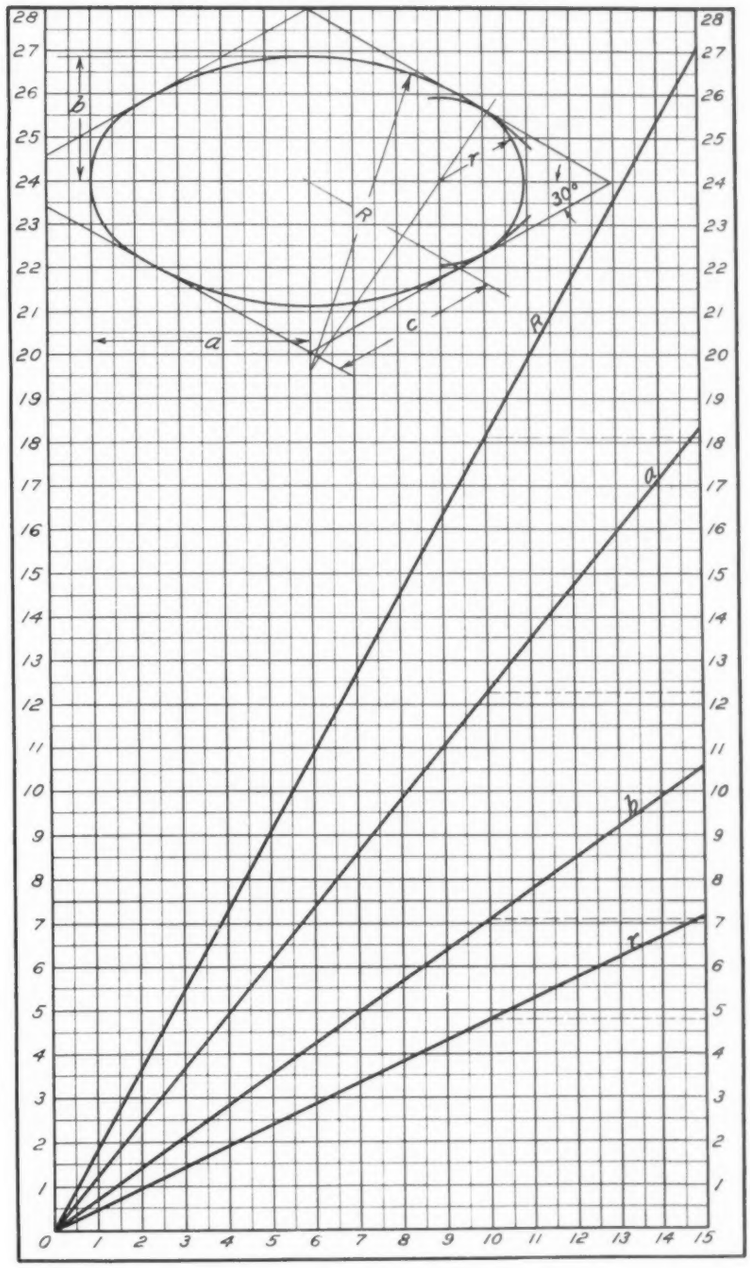
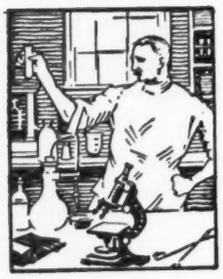



Fig. 2. Chart for Finding Radii Required in Approximate Method of Drawing Isometric Circles of Any Radius c within the Range of 1 to 15 Covered by the Scale at the Bottom of the Chart

## Tool and Equipment Exhibition in Bridgeport

The Bridgeport Tool Engineers Association, Bridgeport, Conn., announces that it will sponsor an Industrial Tools and Equipment Exhibition in the State Armory at Bridgeport, March 6 to 9, 1940. Over one hundred and twenty exhibitors have already taken space. The exhibits will include tools and machine shop accessories of every description, hardening equipment, and unit machine parts. Further information can be obtained from the Bridgeport Tool Engineers Association, State Armory, 1494 Main St., Bridgeport, Conn.

# MATERIALS OF INDUSTRY

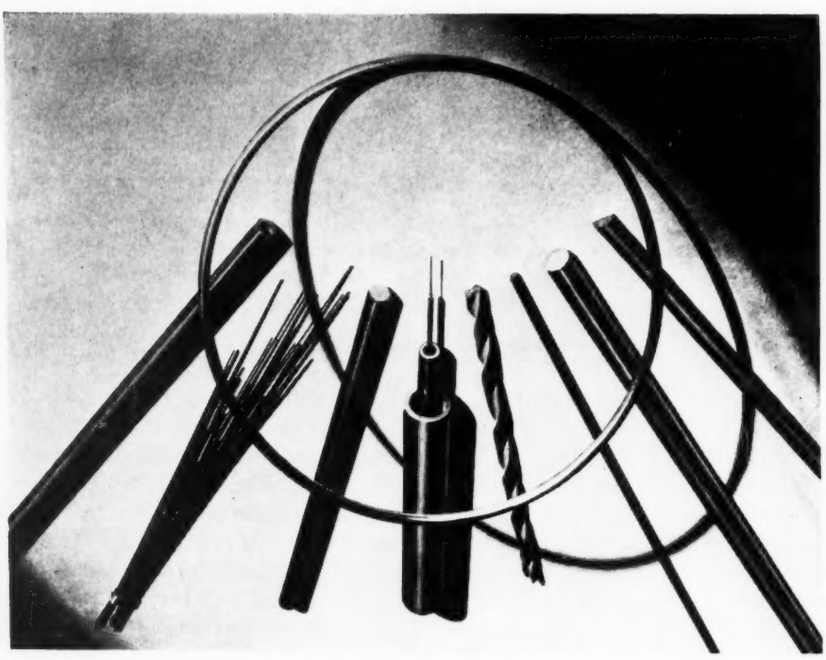


## THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

### Carboloy Tubing, "Spirals," and Bars Produced by Extrusion Process

Tubing, "spirals," and round or shaped bars of Carboloy cemented carbide are now produced by means of an extrusion process developed by the Carboloy Company, Inc., 11,147 E. Eight Mile Road, Detroit, Mich. These products are available in lengths up to 20 inches and within a diameter range of from 0.015 to 0.375 inch. They are formed directly into the desired shapes without most of the hand-forming operations previously necessary.

Carboloy tubing is being produced as small as 0.060 inch outside diameter by 0.030 inch inside diameter, leaving a wall thickness of only 0.015 inch. A supplementary process has been developed by means of which Carboloy rods or bars can be bent to various shapes, as in the case of the 5-inch diameter ring seen in the illustration. This ring consists of a round rod curved to join the ends.



Various Forms to which Carboloy can Now be Extruded, together with a Ring Formed from an Extruded Carboloy Rod

The two new processes make available a range of shapes in sizes heretofore considered economically or mechanically impractical. Such parts as core bushings for ceramic dies, wire guides, valve needles, triangular glass drills, and textile guides are being produced by these methods. Carboloy produced by the extrusion or molding process is as satisfactory in every respect as that made by the cold- or hot-pressed methods.....201

### Agalloyed Steel Tubing Meets Varied Requirements

Steel tubing said to be comparable in quality and appearance to cold-drawn seamless tubing and obtainable at about the same cost as joined seam tubing, has been developed by the AGA Metal Tube Co., Elizabeth, N. J. This tubing is produced by joining spirally wound cold-rolled steel strip in a hydrogen-atmosphere high-frequency induction furnace. Constant pressure is applied to the spiral strip at the moment of joining, and is not relieved until the temperature of the tubing is reduced below the "freezing" point of the bonding material, thus insuring a satisfactory joint. Decarburization is eliminated, even in high-carbon steels, because the actual heating and cooling cycles involve seconds rather than minutes.

The tubing can be made in all straight carbon steels and in chromium-vanadium, chromium-nickel and chromium-molybdenum steels. The sizes manufactured at present range from 1/8 to 5/8 inch outside diameter and from 0.010 to 0.042 inch in wall thickness. The tubing is available in different tempers to suit various uses. It is furnished

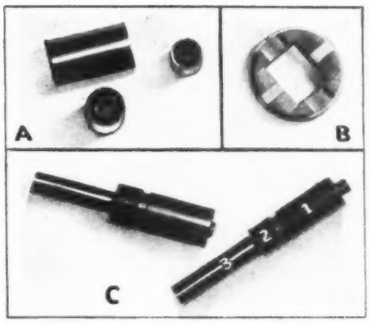


To obtain additional information about materials described on this page, see lower part of page 180.

cold-drawn, and can be bent, coiled, expanded, flared, flanged, spun, machined, or welded to suit desired applications.

The average physical properties of annealed tubing produced from SAE 1010 low-carbon strip steel are: Yield point, from 27,000 to 30,000 pounds per square inch; tensile strength, from 47,000 to 50,000 pounds per square inch; elongation, from 38 to 42 per cent in 2 inches; and reduction in area, from 60 to 68 per cent.

Hard drawn tubing made from the same steel has a tensile strength of from 80,000 to 85,000 pounds per square inch. With high-carbon and alloy steels, a tensile strength in excess of 200,000 pounds per square inch is obtainable by heat-treating in the conventional manner. This tubing is being used in the manufacture of golf-club shafts, fishing rods, radio antennas, automobiles, refrigerators, bicycles, and many other articles.....202




Dies and Gages Made from Kennametal to Obtain Long Life

## Visual Engineering Tests Made Possible by Transparent Plastics

To study the flow of water in the stilling chambers and connecting and inclined tunnels of the Delaware Aqueduct, a model was constructed of Plexiglass by Joseph H. Meyer Bros., New York City, as shown in the illustration. This model makes possible the visual study of the action of liquids and vapors. By adding pigments to water, the efficiency of the apparatus modeled can be easily observed and necessary measurements made.

Plexiglass is a transparent plastic, clearer than glass, which is a product of the Röhm & Hass Co., 222 W. Washington Square, Philadelphia, Pa. As it softens at 200 degrees F., it can be shaped to any desired curve. In constructing the model illustrated, sheets of this material were bent around a form. Holes were then drilled through the material so it could be mounted in metal rings. Plexiglass can also be cemented, sawed, or turned in a lathe to facilitate the construction of models..203

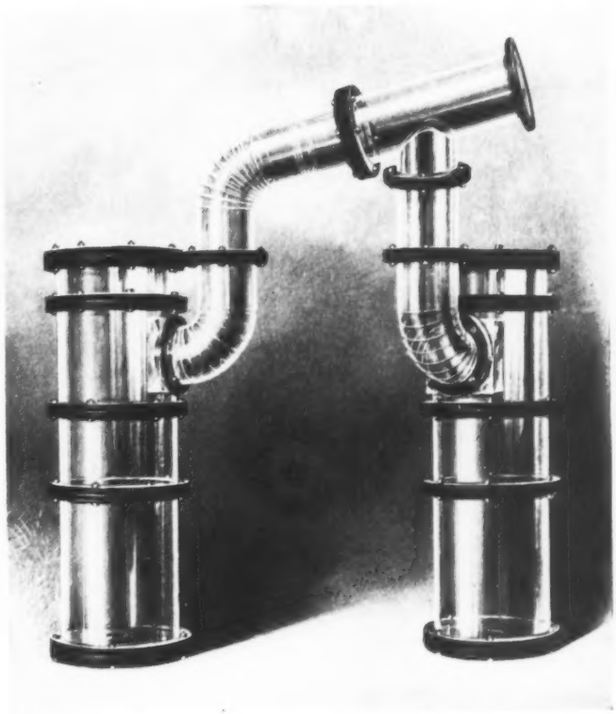
## Variety of Wear-Resisting Parts Made from Kennametal

Kennametal, a product of the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., is now made in almost any shape for parts subject to unusual wear or for gages that must hold their accuracy. A few wear-resisting parts made of Kennametal are shown in the accompanying illustration. At *A* are seen three sizes of extrusion dies used for coating steel welding rods with abrasive flux. At *B* is shown a Kennametal die for pressing articles of refractory aluminous oxide used in the radio industry. The wear-resisting properties of Kennametal make it suitable also for dies used in pressing and forming abrasive ceramic parts. Progressive type plug gages for measuring the bores of steel parts such as ball-bearing races are shown at *C*. Section 1 of this gage was ground to 0.2495 inch diameter and section 2 to 0.2500 inch, providing a work tolerance of 0.0005 inch.

Kennametal is also being used in follow-rests; lathe and grinder center nibs; oil-well pump valves; drill tips for masonry, stone, etc.; drill jig bushings; wire coiling tools; sand-blast nozzles; and similar parts.....204

## Metaseal 494—A Protective Coating for Metal Products

A rust preventive and protective coating for steel, brass, and other metals has been placed on the market by the Estox Products Co., 151-7 Brewery St., New Haven, Conn. This coating, which is known as "Metaseal 494," can be applied by dipping, spraying, or brushing, no special equipment being required for its application. The coating is practically invisible, due to its transparency and thinness.....205



Plexiglass Model of a Section of a Water Supply System which Permits Visual Study of the Water Flow

To obtain additional information about materials described on this page, see lower part of page 180.

## Outstanding Engineers Honored by the A. S. M. E.

At the sixtieth annual meeting of the American Society of Mechanical Engineers, held in Philadelphia during the first week in December, honorary membership was conferred on four outstanding engineers: Dexter S. Kimball, formerly dean of the College of Engineering, Cornell University; Edwin Jay Prindle, retired patent attorney and mechanical engineer of East Orange, N. J.; Charles T. Main, industrial engineer and authority on power and textile plants, Boston, Mass.; and Henry H. Vaughan, consulting engineer and president of the Canadian Foreign Investment Corporation, Montreal, Canada.

The achievements of Dean Dexter S. Kimball are referred to elsewhere in this number (see page 196). Mr. Prindle was awarded an honorary membership because he, as chairman of the Patents Committee of the American Engineering Council and as a representative of the A.S.M.E. on that committee, was largely instrumental in securing the passage of the Lampert Bill, providing much needed relief and increasing the salaries and staff of the Patent Office.

Charles T. Main, one of the outstanding engineers of the United States, was born in 1856, of old New England stock. He graduated from the Massachusetts Institute of Technology in 1876. Having acquired a thorough training in textile mill operation, he became superintendent of the Lower Pacific Mills of Lawrence, Mass., and also had charge of the firm's engineering work. In 1893, the firm of Dean & Main was formed, Mr. Main devoting his entire time to the practice of engineering. When this firm was dissolved in 1907 by mutual agreement, Mr. Main continued practice in his own name, and in 1926, he incorporated his business as Charles T. Main, Inc., of which business he was first president and now chairman. His practice started as a mill engineer and architect, chiefly in the textile field. Gradually the business expanded into a nationally known organization, doing work in many fields of industry, as well as in steam and hydraulic power engineering.

Mr. Main has been active in the affairs of the American Society of Mechanical Engineers. He was president of the Society in 1918. He received the A.S.M.E. medal, the highest award of the Society, in 1935. He is a past-president and honorary member of the Boston Society of Civil Engineers, a past-president of the American Institute of Consulting Engineers, and for eleven years he served as president of the Engineers Club of Boston, of which he is now an honorary member. He has also been active in many other engineering and civic organizations.

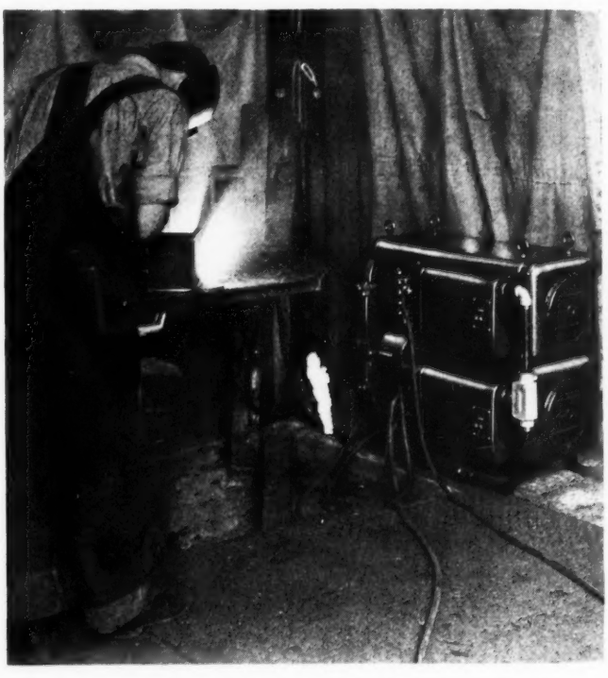
Henry H. Vaughan received his early training and experience in the railway field in England. He came to the United States in 1891 where, because of his ability in the field of railway mechanical engineering, he advanced rapidly to positions of importance. In 1904, he entered the service of the Canadian Pacific Railway with which he remained until 1915, when he became prominently identified with several large Canadian industrial concerns. Since 1920, he has been engaged in private engineering practice.

* * *

## Running Electric Welding Machines in Parallel

The accompanying illustration shows two Pawling & Harnischfeger electric welders, so arranged that either machine can be used alone or both machines employed in parallel, for general job shop welding. These welders, known as the WA-200, have a welding range of from 40 to 225 amperes. However, when a wider range is desired, this can be obtained by "hooking up" the welders in parallel, one being placed on top of the other.

The welders shown are installed in the shop of the Moise Steel Co., Milwaukee, Wis. With the arrangement shown, two operators can be employed for welding small work, the machines being used separately. For heavier work, the machines can be used in parallel, one operator doing the welding work. Another advantage of the arrangement is that if there is work for one small machine only, the other can be shut down, and the welding done at less than one-half the power cost required for a large machine capable of handling the heavier work sometimes encountered.



Two Pawling & Harnischfeger Electric Welders Arranged so that They can be Used Separately or in Parallel

# NEW TRADE LITERATURE

*Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 179 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January Number of MACHINERY*

## Poster of Time-Saving Reference Tables

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Poster entitled "Helps for Sheet Metal Men," containing tables of circumferences and areas of circles, formulas for estimating weight of metal for rectangular and round duct work, and standard U. S. gage for sheet iron. ..... 1

## Bevel Gear Generators

BILGRAM GEAR & MACHINE WORKS, 1217-1235 Spring Garden St., Philadelphia, Pa. Catalogue descriptive of the Bilgram automatic bevel gear generators; complete instructions are given for operating the 6-inch machine. A description of the Bilgram chamfering machine especially designed for spiral bevel gears is included. ..... 2

## Turret Lathes

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogues illustrating and describing saddle type universal turret lathes 7A, 7B, and 7D; saddle type universal turret lathes 8A, 8B, and 8D; ram type universal turret lathes Nos. 3, 4, and 5; and the 8-inch Fay automatic lathe. ..... 3

## Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA 246F, on high-speed synchronous motors; 1758B, on ammeters, voltmeters, wattmeters, power-factor meters, frequency meters, and special instruments; 3248, on direct-current magnetic starters; and 1784B, on portable instruments. ..... 4

## Ventilating Equipment for Industrial Plants

AMERICAN MACHINE & METALS, INC., DeBothezat Ventilating Equipment Division, East Moline, Ill. Catalogue covering "Bifurcator" ventilating equipment especially designed for conveying corrosive, high-temperature, and hazardous fumes or gases. ..... 5

## Electric Equipment and Maintenance Tools

IDEAL COMMUTATOR DRESSER CO., 1250 Park Ave., Sycamore, Ill. Folder illustrating and describing various types of equipment built by the company, including variable-speed transmissions, tools used in the maintenance of electric equipment, and electric markers and etchers. ..... 6

## Cutting Oils, Carburizers, Heat-Treating Salts, Etc.

E. F. HOUGHTON & CO., Philadelphia, Pa. Booklet entitled "Houghton Products for the Metal-Working Industries," covering cutting oils, hardening compounds and carburizers, quenching oils, drawing and tempering salts, leather belting, and packing. ..... 7

## Recording Instruments

BRISTOL CO., Waterbury, Conn. Bulletin 546, describing the Rockwell Bristol "Dilatometer," a direct-reading instrument that indicates and records in ink time- and temperature-dilatation changes during the heating and cooling cycles of metals and many other kinds of materials. ..... 8

## Slide-Rule for Machining Stainless Steel

RUSTLESS IRON & STEEL CORPORATION, Baltimore, Md. Slide-rule or chart for finding speeds, feeds, and depth of cuts in machining different types of stainless steel. The reverse of the chart has suggestions on tool design, grinding, and coolants. ..... 9

## Electric Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Circular illustrating and describing the 200-ampere "Shield-Arc Junior" welder with self-indicating dual continuous control. Application Sheet No. 67, containing facts and figures on the economics of welding as applied to machine design. ..... 10

## Non-Corrosive Casters

HAYNES MFG. CO., 709 Woodland Ave., Cleveland, Ohio. Leaflet describing the company's improved "Roll-Easy" caster suitable for shop trucks. This is a ball-bearing, non-corrosive, heavy-duty all-steel caster with replaceable rubber tire. ..... 11

## Welding Electrodes

MCKAY CO., York, Pa. Bulletin E-16, containing tentative specifications for iron and steel shielded-arc welding electrodes approved by both the American Welding Society and the American Society for Testing Materials; also information on selecting electrodes to suit different classes of work. ..... 12

## Weighing Scales

TOLEDO SCALE CO., Toledo, Ohio. Circular entitled "45,000 Ways to Weigh," containing over one hundred illustrations showing the use of Toledo scales in a wide variety of industries, both in the United States and throughout the world. ..... 13

## Gears

ILLINOIS GEAR & MACHINE CO., 2108 N. Natchez Ave., Chicago, Ill. Catalogue 39, containing price lists of cut gears, as well as engineering data on the design of gearing and the computing of power transmission capacity. ..... 14

## Measuring Instrument for Coatings

AMERICAN INSTRUMENT CO., 8010-8020 Georgia Ave., Silver Spring, Md. Bulletin M-2070, describing the "Magne-Gage" for measuring thicknesses of coatings on various materials. ..... 15

### Thread-Grinding Machines

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit, Mich. Bulletins 14091 and 14191 illustrating and describing two new types of Ex-Cell-O precision thread grinding machines suitable for accurate production grinding. 16

### Honing Machines

HONING EQUIPMENT CORPORATION, 4612 Woodward Ave., Detroit, Mich. Circular illustrating and describing a floor type production honing machine that is designed to accurately hone bores up to 2 inches in diameter. 17

### Arc-Welding Electrodes

GENERAL ELECTRIC CO., Schenectady, N. Y. Publication GEA 1546F, prepared as a guide for the proper selection of arc-welding electrodes, with complete description of twenty types. 18

### Cutting Speed Conversion Table

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Cutting speed conversion table for diameters from 1/2 inch to 8 inches and cutting speeds from 90 to 550 feet per minute. 19

### Slide-Rule Covering Bolt Information

ROCKFORD SCREW PRODUCTS CO., 2501 Ninth St., Rockford, Ill. Slide-rule pertaining to bolts, giving dimensions, tolerances, and prices of bolts made by the company. 20

### Flame-Cutting Machines

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Bulletin on the new Airco No. 10 Planograph —a gas-cutting machine of the pantograph type for single- or double-torch operation. 21

### Shop Equipment

ATLAS PRESS CO., Dept. 7, 1819-2019 N. Pitcher St., Kalamazoo, Mich. General catalogue 40 (72 pages) on Atlas shop equipment, covering lathes, drill presses, shapers, and arbor presses. 22

### Surface Temperature Pyrometers

WHEELCO INSTRUMENTS CO., 1929 S. Halsted St., Chicago, Ill. Bulletin 2850-1, descriptive of a pyrometer for precise readings of all surface temperatures. 23

### Ball Bearings

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. Bulletin F-15, on the application of ball bearings to the crankshaft of small air-cooled single-cylinder engines. 24

### Pulleys and Couplings

CONGRESS TOOL & DIE CO., 9030 Lumpkin Ave., Detroit, Mich. Catalogue 139, showing this company's line of V-belt pulleys and flexible couplings. Engineering data and general information are included. 25

### Automatic Lubrication

BIJUR LUBRICATING CORPORATION, Long Island City, N. Y. Bulletin J, entitled "Automatic Lubrication—Why?", containing fourteen reasons why automatic lubrication pays the machine user. 26

### Diamond Dressers

STANLEY ELECTRIC TOOL DIVISION, STANLEY WORKS, New Britain, Conn. Circular descriptive of a new diamond dresser fixture available for use on the Stanley No. 150 contour grinder. 27

### Remote Control

TOMKINS-JOHNSON CO., Jackson, Mich. Bulletin RC-4, illustrating and describing the Tomkins-Johnson pneumatic remote control systems and their application on machine tools. 28

### Self-Closing Dust Caps

GITS BROS. MFG. CO., 1858 S. Kilbourn Ave., Chicago, Ill. Circular illustrating and describing self-closing dust caps, which give permanent protection against dust, water, and other objectionable elements. 29

### High-Speed Drills

WHITMAN & BARNES, 2108 W. Fort St., Detroit, Mich. Circular entitled "The Right Drill for Every Job," listing six types of high-speed drills suitable for drilling various metals and materials. 30

### Bearings and Bearing Metals

LUMEN BEARING CO., Buffalo, N. Y. Booklet entitled "Supplement to Engineers' Handbook," containing 70 pages of engineering data on bearings and bearing alloys. 31

### Multi-Speed Reducers

ADAMS CO., Dubuque, Iowa. Catalogue 201, on Adams "Multi-Speed" reducers, giving complete tables of output speeds and horsepower ratings for the various sizes. 32

### Magnetic-Base Dial Indicators

BROWN & SHARPE MFG. CO., Providence, R. I. Circular descriptive of Brown & Sharpe dial test indicators with magnetic bases for convenience in application. 33

### Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet F-8488, describing shaded-pole low-horsepower motors for unit heaters, fans, air conditioners, etc. 34

### Cold-Finished Bar Steel

LA SALLE STEEL CO., Chicago, Ill. Bulletin describing the physical properties and typical applications of "Stressproof" No. 2 cold-finished steel bars. 35

### Clutches with Overload Release

CONWAY CLUTCH CO., 1543 Queen City Ave., Cincinnati, Ohio. Bulletin S-10, containing tables of dimensions and prices covering the Conway overload release disk clutches. 36

### Zinc Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. Booklet entitled "Zinc Alloy Die-Castings in Small Tools," showing a great number of actual applications. 37

### Self-Locking Nuts

SCOVILL MFG. CO., Waterbury, Conn. Bulletins on Boots self-locking nuts of the duralumin anchor type and the semi-finished hexagon type. 38

### Welding Equipment

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B-6049, announcing the Weld-O-Tron unit, a new low-current electronic welder for precision work. 39

### Electric Controls

ALLEN-BRADLEY CO., 1331 S. First St., Milwaukee, Wis. Calendar for 1940, incorporating the cartoons featured in the Allen-Bradley industrial advertising. 40

### Pumps for Hydraulic Equipment

JOHN S. BARNES CORPORATION, Rockford, Ill. Bulletin covering piston pumps for hydraulics, PA-14-16-

17-18 series; and gear pumps for hydraulics, PA-20 series. ..... 41

### Welding Table

RANSOME CONCRETE MACHINERY Co., Industrial Division, Dunellen, N. J. Bulletin 160, illustrating a new revolving, tilting welding table and many applications on different kinds of work. ..... 42

### Roller Bearings

BOWER ROLLER BEARING Co., 3040 Hart Ave., Detroit, Mich. Bulletin entitled "How Bower Roller Bearings Undergo a Face-Lifting Operation by Micro-Honing." ..... 43

### Collet Chucks

ERICKSON STEEL Co., E. 60th St. and Bessemer Ave., Cleveland, Ohio. Folder describing "Precision" collet chucks for close accuracy in drilling and end-milling. ..... 44

### Welding Accessories and Electrodes

HOBART BROS. Co., Box EW-68, Troy, Ohio. Twenty-page booklet covering electric welding accessories and electrodes. ..... 45

### Electric Arc Welder

OWEN-DYNETO DIVISION OF USL BATTERY CORPORATION, Syracuse, N. Y. Bulletin describing the new USL protected arc alternating-current welder. ..... 46

### Variable-Speed Control

REEVES PULLEY Co. OF N. Y., INC., 76 Dey St., New York City. General catalogue G-397, descriptive of the Reeves complete line of variable-speed control equipment. ..... 47

### Milling Attachments

FRAY MACHINE TOOL Co., Glendale, Calif. Bulletin describing "All Angle" milling attachments of the high-speed and heavy-duty back-geared types. ..... 48

### Cold-Finished Screw Stock

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa. Circular 118VM, describing the new J & L Bessemer flame-control cold-finished screw stock. ..... 49

### Stainless-Steel Flexible Tubing

CHICAGO METAL HOSE CORPORATION, Maywood, Ill. Bulletin SS-16, covering stainless-steel fully corrugated flexible units and divided flexible units. ..... 50

### Slip Roll Forming Machines

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 77-B, covering power-operated heavy slip roll forming machines. ..... 50-A

### Toolmakers' Microscope

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago, Ill. Bulletin 147, descriptive of a toolmaker's microscope. ... 50-B

### Stamping Tools

PITTSBURGH STENCIL & TOOL Co., 400 Penn Ave., Pittsburgh, Pa. Circular illustrating and describing Markwell holders for stamping steel and other metal products. ..... 50-C

### Turret Lathes

WARNER & SWASEY Co., Cleveland, Ohio. "Blue Chips," a monthly publication giving information useful to turret lathe operators. ..... 50-D

### Flame-Cutting

LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York City. Bulletin entitled "Flame Gouging—an Economical Method of Grooving Steel." ..... 50-E

### Tapping Machines

BAKEWELL MFG. Co., 2427 E. 14th St., Los Angeles, Calif. Catalogue descriptive of the No. 1 Bakewell precision tapping machine. ..... 50-F

### Washers and Stampings

WROUGHT WASHER MFG. Co., 2100 S. Bay St., Milwaukee, Wis. Stock list 55-C, covering washers made from various types of materials. 50-G

### New and Rebuilt Machinery

J. L. LUCAS & SON, INC., 3 Fox St., Bridgeport, Conn. Bulletin 104-S,

---

## To Obtain Copies of New Trade Literature

**listed on pages 177-180 (without charge or obligation) mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:**

**MACHINERY, 148 Lafayette St., New York, N. Y.**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 50-A | 50-B | 50-C | 50-D | 50-E | 50-F | 50-G | 50-H | 50-I | 50-J | 50-K | 50-L | 50-M | 50-N | | | | | | | | | | | | | |

*Name* ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

*Firm* .....

*Business Address* .....

*City* ..... *State* .....

**[SEE OTHER SIDE]**

listing new and rebuilt machine tools available through this company. 50-H

### Cutting-Off Machines

BRIDGEPORT SAFETY EMERY WHEEL CO., INC., 1270 W. Broad St., Bridgeport, Conn. Circular illustrating and describing the new Bridgeport "Abrasaw" wet cutting-off machine. 50-I

### Threading Machines

GEOMETRIC TOOL CO., New Haven, Conn. Bulletin TM-1, covering various types and sizes of precision threading machines. ..... 50-J

### Pyrometers

RUSSELL ELECTRIC CORPORATION, 343 W. Huron St., Chicago, Ill. Folder describing "Hold-Heet" portable lance type pyrometers. ..... 50-K

### Electric Control Devices

STRUTHERS DUNN INC., 1315 Cherry St., Philadelphia, Pa. Catalogue of 32 pages, covering relays, timing devices, and thermostats. ..... 50-L

### Reversing Planer Drives

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins 3285 and 3292, dealing with G-E reversing planer motor drives. ..... 50-M

### Small Tools

MILLERS FALLS CO., Greenfield, Mass. Catalogue 42, covering this company's complete line of tools. ..... 50-N

The Broach Here Shown—One of the Longest Single-piece Hardened and Ground Broaches ever Produced—was Recently Made by the Colonial Broach Co., for a Tractor Manufacturer. It is Designed for the Complete Finishing of Splines in Tractor-drive Bevel Gears at a Single Pass. The Broach is over 80 Inches Long and Approximately 5 Inches in Diameter. It is Used in a Broaching Machine Having a 6-foot Working Stroke

## Neoprene Garments for Industrial Workers

Neoprene chemical rubber, a product of the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., is now being used for over-garments by industrial workers to protect their regular clothing. Neoprene differs from rubber in that it resists the action of gasoline, oils, solvents, and greases. The new garments, therefore, are suitable for protecting the clothing of machine operators from oil thrown off in cutting operations. They are also suitable for workers in chemical plants, steel mills, etc., where chemicals are used.

* * *

## Effect of Automobile and Bus Transportation on Railways

The effect of automobile and bus transportation on railway passenger service is indicated by the fact that, in 1921, the railroads of the United States carried 1,035,496,000 revenue passengers, as compared with 452,731,000 in 1938. On the basis of passenger miles, the figure for 1921 is 37,312,600,000, while in 1938 it was 21,628,718,000. In the same period, the registration of motor vehicles increased approximately from 9,500,000 to 25,250,000. The operating revenues of the railroads decreased from about $5,500,000,000 in 1921 to $3,550,000,000 in 1938.

---

## To Obtain Additional Information on Shop Equipment

**Which of the new or improved equipment described on pages 181-194 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 181-194—or write directly to the manufacturer, mentioning machine as described in January MACHINERY.**

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |

**Fill in your name and address on other side of this blank.**

## To Obtain Additional Information on Materials of Industry

**To obtain additional information about any of the materials described on pages 174-175 mark with X in the squares below, the identifying number found at end of each description on pages 174-175—or write directly to the manufacturer, mentioning name of material as described in January MACHINERY.**

| | | | | |
|---|---|---|---|---|
| 201 | 202 | 203 | 204 | 205 |

**Fill in your name and address on other side of this blank.**

**Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.**

**[SEE OTHER SIDE]**

# *Shop Equipment News*

*Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market*

## Norton "Multipurpose" Grinder and Improved Cylindrical Grinders

An entirely new universal grinder known as the Type LC "Multipurpose," which performs with equal facility both external and internal grinding, has been brought out by the Norton Co., Worcester, Mass. The table of this machine can be operated hydraulically or by hand through a two-speed arrangement which provides for quick positioning or a slower movement as required for shoulder grinding. Engaging the power traverse disengages the hand traverse, and vice versa. The rapid hand traverse is disengaged and the slow traverse engaged by moving a single lever.

The wheel-feed mechanism has two ranges of feed, either of which can be selected through a single knob. Each hole in the adjusting index of the wheel feed is equivalent to a reduction in the work diameter of 0.0004 inch in the fast range, and 0.0001 inch in the slow range. A stop is provided against which the handwheel can be located for either external or internal grinding. An electric control permits the amount of dwell at each reversal of the table to be easily adjusted. This unit is accessible at the front of the machine.

The universal headstock is driven by either a 1/2-H.P. constant-speed alternating-current or an adjustable-speed direct-current motor. In the latter case, cone type V-pulleys provide four work speeds ranging from 65 to 260 R.P.M. The work speed is push-button controlled. The change from live-spindle to dead-center operation is effected by a knob at the front of the headstock. The graduated base can be set at any angle either side of the zero position. All bearings are pressure-lubricated.

The wheel-slide can be swiveled to any angle and fed at this angle, or it can be set at an angle and fed in a direction perpendicular to the table ways. The wheel feed is obtained by a feed-screw and a double half-nut with an adjusting screw that provides for performing both external and internal grinding with equal accuracy.

The internal grinding spindle is mounted on the front of the wheel-slide and is driven by a flat belt from the same motor that drives the external spindle. The pulleys for driving both spindles can remain mounted on the motor shaft. A selector switch can be used to reverse the motor for internal operations.

The machine swings 12 inches, and is built in 24-, 36-, 48-, and 72-inch lengths ranging in weight from about 5000 to 7000 pounds. It requires a floor space approximately 5 feet wide by 9 1/2 to 17 1/2 feet long.

The Norton Co. has also placed on the market recently a new line of 10-inch Type C cylindrical grinders, which, although bearing the same type designation as a previous model, embody several improvements in the design. The most outstanding change in this machine is in the general appearance, resulting from the development of a new base in which the oil and coolant pumps are suspended vertically on springs, so that they now run submerged. The oil and coolant reservoirs are an integral part of the base. All the motor starting equipment is mounted in a large cored compartment in the base, where it is protected from dust and moisture. The equipment is exposed for inspection or servicing by simply removing a cover.

The wheel-slide and table ways are pressure-lubricated from a separate system, so that oils of different viscosities can be used for lubricating purposes and for the operating fluid of the various hydraulic units. V-belts and a silent chain running in oil comprise the headstock drive, which is of improved design. The footstock has also been improved. Large spindles and centers are employed to

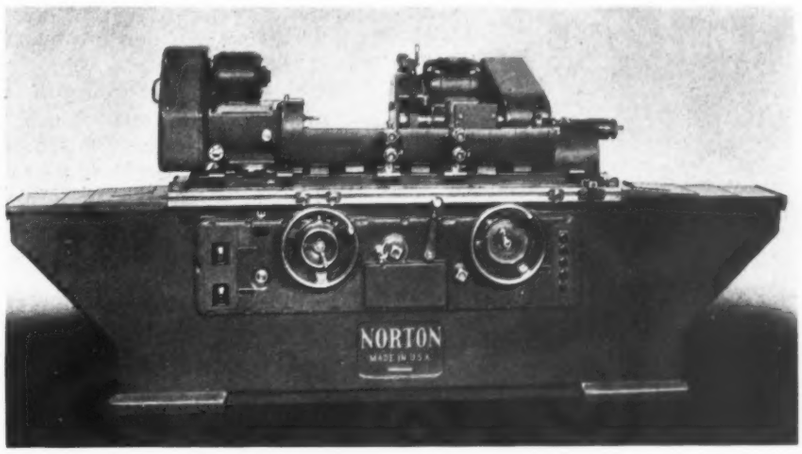



Fig. 1. Norton "Multipurpose" Universal Grinder with Splash Guards in Place

To obtain additional information on equipment described on this page, see lower part of page 180.

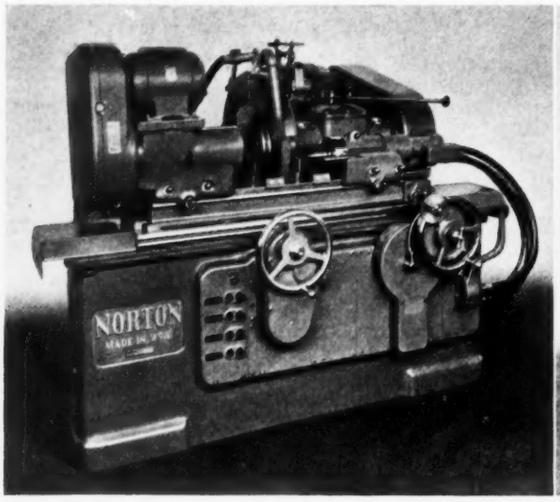



Fig. 2. Norton Type C Semi-automatic Grinder

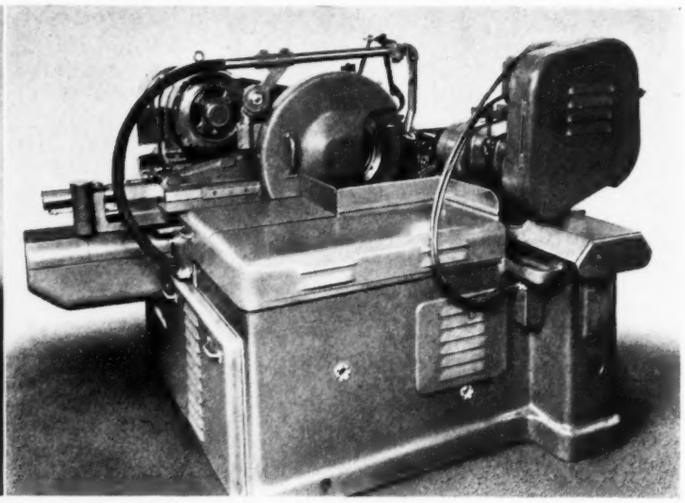


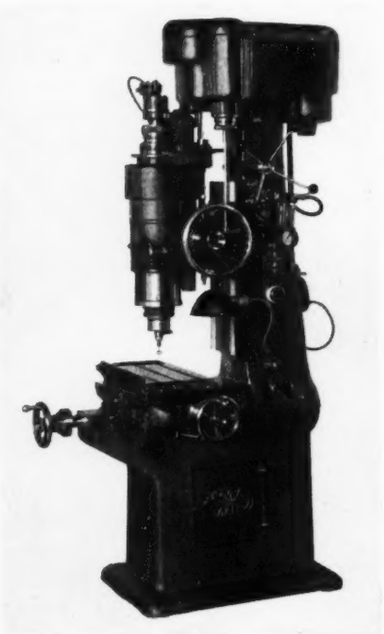
Fig. 3. Side View of Machine Shown in Fig. 2

obtain more rigid support for the work and thus improve the surface finish.

The Type C machines are available with hand, hydraulic, or mechanical traverse for the table. A semi-automatic model is also built which can be arranged for either hand or hydraulic table traverse. Semi-automatic machines are usually equipped with a hydraulically operated footstock and headstock, and a hydraulically operated steadyrest can also be supplied.

In plunge-cut grinding, the operator places the work between the centers and moves a single lever which starts the following cycle of movements: Work-centers close; wheel-slide advances rapidly; work rotation begins; rapid advance of wheel is decelerated to grinding feed; wheel feed is arrested by a positive stop and wheel dwells for final finish and size; wheel-slide retracts rapidly; and work rotation stops. The footstock center is withdrawn by a lever for removing the work.

The automatic features in some cases enable one man to operate two machines. Semi-automatic machines can also be arranged for manual control. These machines can be converted from manual to automatic control by merely operating a switch. ..... 51



Moore Precision "Jig Grinder" for Correcting the Location of Holes

## Moore Jig Grinder

The Moore Special Tool Co., Inc., Bridgeport, Conn., has developed a new tool-room machine designated the "Jig Grinder" because of its similarity, in principle, to a jig borer. This machine is sold through Marburg Bros., Inc., 90 West St., New York City. It is designed primarily to correct the location of holes in hardened-steel parts, jigs, master plates, gage parts, etc., being especially adapted for use in making precision, compound, and progressive dies that frequently require holes to be spaced accurately within limits of 0.0005 inch or less.

The top housing contains the motor and variable-speed drives for both speeds and feeds. The infinitely variable speed control covers a range of from 50 to 150 R.P.M., and the feed control has a feed range of from 0.004 to 0.020 inch per spindle revolution.

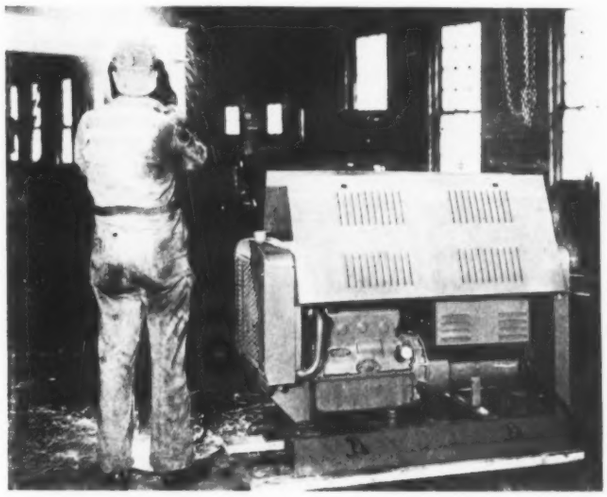
The main spindle consists of a large sleeve mounted on two preloaded precision ball bearings. Inside this sleeve is a vertical slide fitted in slideways. The slideways are pivoted at the bottom to allow the slide to be tilted 1 1/2 degrees either side of the vertical position for grinding taper holes. The lower end of the vertical slide carries a cross-slide on which is mounted the grinding head. The cross-slide has manual adjustment up to 1 inch while the spindle is stationary. The cross-slide can also be adjusted up to a limit of 0.100 inch while the spindle is in motion through a dial graduated with one hundred lines spaced about 1/8 inch apart, each graduation representing a cross-slide movement of 0.0001 inch. Three special grinding heads can be attached to this cross-slide, giving a total range of grinding wheel speeds of from 15,000 up to 80,000 R.P.M.

Both air and electrical connections enter the spindle at the top and are carried all the way down inside the spindle unit. This makes it possible to guard all the lower working parts from emery dust. The up and down power feed on the vertical slide can be set for automatic reversing, so that the grinding wheel reciprocates, but can also be tripped or reversed by hand at any position. The table has a range of movements up to 9 1/8 by 14 1/4 inches. The maximum distance from the table to the wheel is 8 inches. The working surface of the machine table is 10 by 16 inches. ..... 52



To obtain additional information on equipment described on this page, see lower part of page 180.

Tocco Junior Surface-hardening Machine



Lincoln Engine-driven Arc Welder in Operation

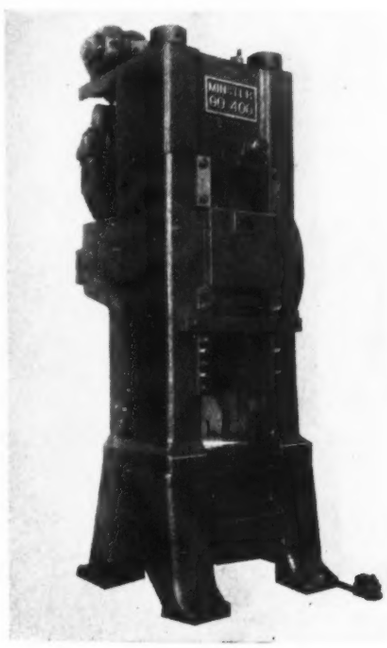
## Surface-Hardening Machine for Small Parts

The Ohio Crankshaft Co., 6600 Clement Ave., Cleveland, Ohio, has recently added to its line of Tocco hardening machines a Junior model which is adapted for surface-hardening a large variety of small parts with the same accuracy, speed, and economy obtained with the larger units. This machine reduces to seconds local surface-hardening operations that formerly required hours, and can be adapted for localized drawing, brazing, soldering, and heating for bending or forming.

The new machine is available in four sizes having 8, 15, 22, and 30 K.V.A. capacities. The cabinet size is 78 by 36 by 36 inches. ..... 53

## Minster Embossing Press

The knuckle-joint embossing press here illustrated is one of eight sizes of a new Model 90 series brought out by the Minster Machine Co., Minster, Ohio. All the presses of this series, which covers a capacity range of from 150 to 1500 tons, are of four-piece steel tie-rod construction. The 600-ton and larger presses are equipped with the Minster air-operated combination multiple-disk clutch and brake. This type of drive unit can be supplied on the smaller presses in place of the positive clutch, if desired.



Knuckle-joint Embossing Press Built by Minster Machine Co.

The massive knuckle assembly is equipped with over-size alloy-steel pins and hardened and ground steel bushings. Each knuckle bearing is connected to a high-pressure continuous-circulating oil lubrication system. A cascade of oil also flows over the knuckle assembly. A dual oil filter is provided to insure a clean supply of oil.

The dwell obtained at the bottom of the stroke with this knuckle type press is particularly suited for coining, embossing, sizing, heading, heavy stamping, cold-forging, and similar operations where a delay in the upward movement of the press ram, combined with high pressure, is required to permit the metal to flow or set. ..... 54

## Lincoln Arc Welder

A new engine-driven arc welder designated the SAE-200-J has been placed on the market by the Lincoln Electric Co., Cleveland, Ohio. This welder is of the single-operator, variable-voltage type, with a current range of 40 to 250 amperes for either bare, washed, or heavily coated electrodes. It is of exceptionally light weight and small size for its capacity, weighing less than 900 pounds and measuring about 64 inches in overall length by 20 inches wide by 37 inches high in the stationary type. The portable or shop type model is the same length, but 27 1/2 inches wide by 44 1/2 inches high.

The generator is driven by a four-cylinder engine which delivers 26 H.P. at 1800 R.P.M. An eight-gallon tank provides fuel for about one day of normal operation. The entire unit remains properly balanced when lifted by a single crane hook. The portability of this equipment adapts it for a wide range of arc-welding applications, including the welding of light-gage metal by the metallic arc process. Galvanized sheets can be welded by the carbon arc method. The welder can also be used for repairing cast-iron parts and for hard facing. ..... 55

## Corrosion-Resistant Fafnir Bearing Units

A process whereby exposed parts of ball-bearing transmission units are chemically treated to resist corrosion has been developed by the Fafnir Bearing Co., New Britain, Conn. A jet-black oxide layer is

To obtain additional information on equipment described on this page, see lower part of page 180.

formed which penetrates from 0.0002 to 0.0003 inch into the surface of the metal without changing the external dimensions of the work. This protective layer is actually part of the metal itself. It does not chip or peel, and is unaffected by temperature. The United States Navy salt spray corrosion tests indicate that ball-bearing units so treated resist corrosion from ten to twenty-five times as well as untreated metal. 56

## Redesigned Ex-Cell-O Precision Boring Machines

The Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich., has redesigned its line of "Junior" and "Senior" precision boring machines and has added a new improved hydraulic control. These improved machines have been styled to conform to the lines of other redesigned machines made by the company, such as thread grinders, tool grinders, and hydraulic units.

All the hydraulic operating controls are located in one panel at the front of the machine. The table movement is controlled automatically, after starting, by adjustable table dogs, below which are five hydraulic control plungers. At each side of the control panel are three graduated dials, the two upper dials serving to control the rate of the first and second feeds for the table travel in both directions. The lower dials control the dwell time at each end of the table stroke. Manual starting is effected by a lever, and manual control of the direction of movement, by a knob in the middle of the panel.

The hydraulic system provides for a constant rate of rapid traverse and two adjustable feed rates in each direction of table travel; the choice of either immediate table return, or, with table stops, an adjustable dwell and return; and automatic jump feeding, or rapid traverse between two feeding cuts. Provision is made for connecting hydraulically operated fixtures and spindle chucks to the pressure and exhaust lines to coordinate their operation automatically with the table cycle. Dogs on the rear of the table can be used to control starting and stopping of the spindles and the flow of coolant. Hydraulic pressure is supplied by a motor and pump mounted on a separate rubber-insulated base at the rear.

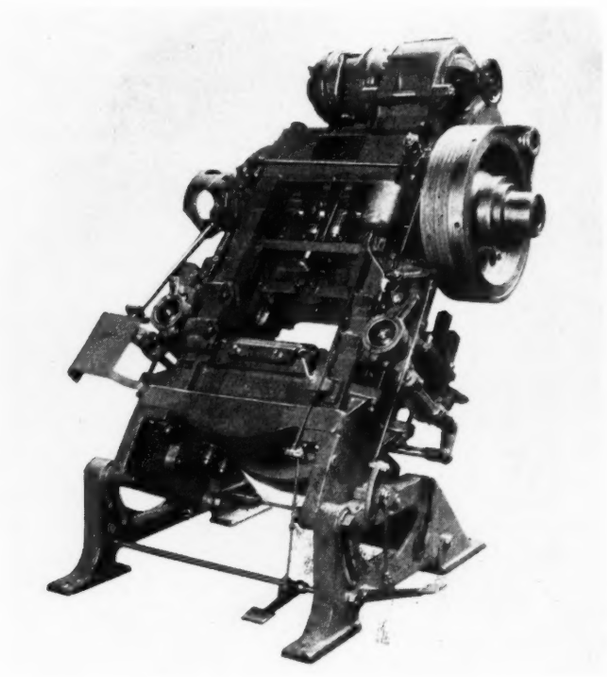
From one to four spindles can be mounted on a bridge, giving a wide range of spindle center distances. An Ex-Cell-O universal fixture can be used for handling a wide range of parts and for small lots where frequent change-overs are necessary. For production runs, a single-purpose fixture, operated by hand, hydraulically or pneumatically, can be used.

The "Junior" precision boring machine has a capacity for boring holes from 3/8 inch to 6 inches in diameter; a maximum table travel of 12 inches; a table feed of 1/2 inch to 40 inches per minute; and a rapid traverse feed of 15 feet per minute. The "Senior" machine has a capacity for boring holes from 3/8 inch to 8 inches in diameter; a maximum table travel of 16 inches; a table feed of 1/4 inch to 18 inches per minute; and a rapid traverse of 10 feet per minute. ..... 57

## Bliss High-Production Press with Inclinable Mounting

The E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., has developed a new inclinable mounting which is now available for its No. 645 series high-production presses. This mounting allows the machine to be operated in any one of three positions. The square pockets in the legs of the press support the machine, permitting it to be used for work which is blanked through the dies and bed while the press is in an upright position. It can also be used for work that is either ejected by

Ex-Cell-O Redesigned Precision Boring Machine Provided with Hydraulic Control



Bliss Press with Inclinable Mounting that Permits Operation in Three Different Positions



To obtain additional information on equipment described on this page, see lower part of page 180.

the bar knock-out or is returned to the surface of the die and discharged by gravity while the press is inclined. Adjustable cam knock-outs are also available.

The press is equipped with precision type bronze-lined gibs which are adjustable to 0.0005 inch; bronze ball-seats for the connections; and bronze-bushed main bearings with automatic force-feed lubrication. The Bliss high-speed rolling key clutch of compact size, with its auxiliary fittings, is responsible for the fast action of these presses. The Bliss precision type feed with hardened gearing, rollers, and pins is also available.

The bolster and clamping cap of the press are so designed that the dies can be easily set and tried out without returning the press to the vertical position. The operating speeds are 100 to 300 strokes per minute and are under the control of a variable-speed drive unit that adapts the press for a wide range of work. 58

## Hydraulic Unit for Punching and Countersinking Holes in Window-Trim Moldings

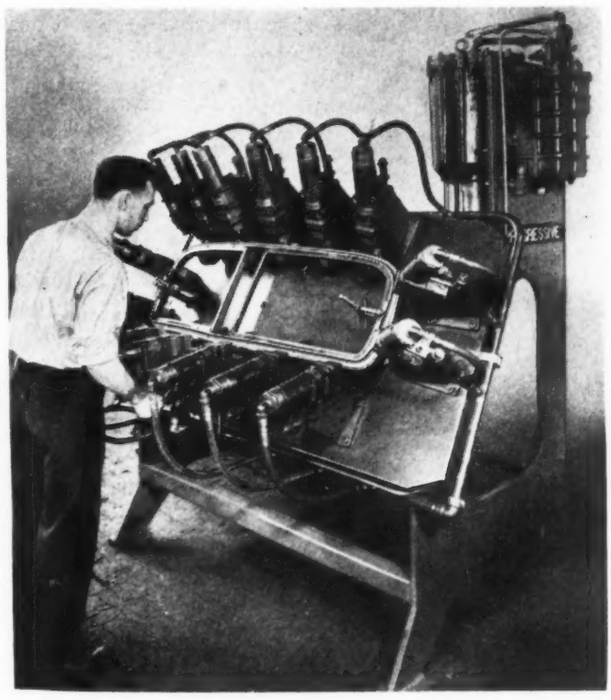
The Progressive Welder Co., 717 Piquette Ave., Detroit, Mich., has recently built a hydraulic punching unit employing a balanced spring principle which has made possible a great reduction in the time required for punching and countersinking the mounting holes in windshield and window-trim moldings. Over 200 moldings an hour, with from twelve to sixteen holes each, are being turned out per fixture in one plant with this new equipment.

The complete unit comprises from twelve to sixteen individual hydraulic punching units, a nesting form for the work, and an air-hydraulic booster for operating the punching units. The units are of simple single-acting construction, actual operation producing motion in two directions. When hydraulic pressure is first admitted to the unit, the piston moves toward the work, bringing a die into contact with the work and holding it securely against the nesting form. As the forward movement ceases, pressure increases within the cylinder, causing the cylinder to move away from the piston against spring pressure. To the cylinder of the unit is connected the punch and counterpunch, which thus pierce the work from the far side.

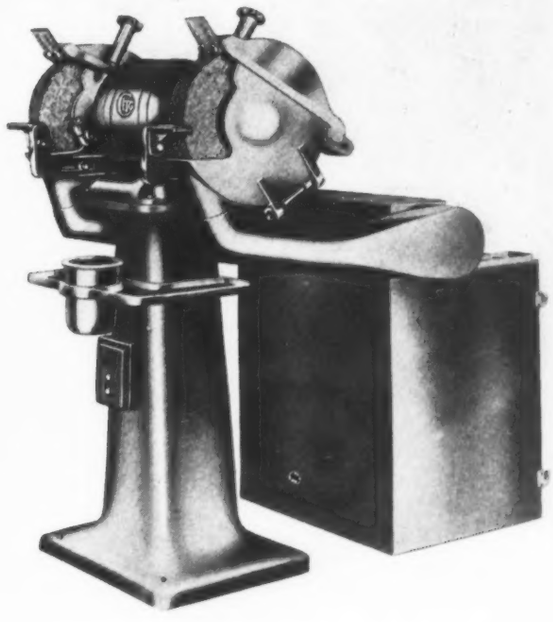
In operation, hand-clamps at each end of the nesting form position the work until the operator presses a starting button, which brings the die of each punching unit into contact with the work under a comparatively low hydraulic pressure (90 pounds). As soon as the dies come in contact with the work and clamp it securely in the nesting form, the resulting back pressure trips the main pressure switch, bringing the hydraulic booster into full action to complete the punching operation. 59

## Air Purifier Attachment for Grinders

An air purifier attachment for grinders and buffers, known as the "Air Master," has been developed by the Cincinnati Electrical Tool Co., 2674-6 Madison Road, Cincinnati, Ohio. This attachment draws the dust and grit from the grinding wheels and filters the air through a series of filter bags. The air is thus returned to the room fresh and pure. The dust and grit are collected in a large tray at the bottom of the cabinet, operation of a foot-lever serving to shake the lighter particles from the filter bags into the tray, which is removable for easy cleaning. The air-purifying unit and the grinding machine are regularly controlled by the same switch, so that they start simultaneously.



Hydraulic Unit Built by the Progressive Welder Co. for Punching and Countersinking Window-trim Moldings



Grinder Equipped with "Air Master" which Collects Grit and Dust from Wheels and Returns Filtered Air to Room

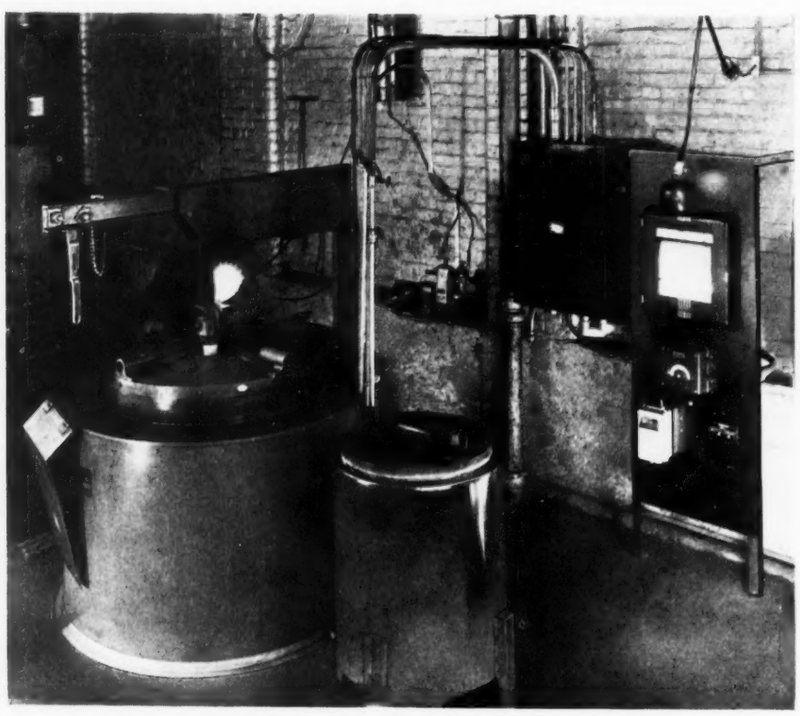
To obtain additional information on equipment described on this page, see lower part of page 180.

The fully enclosed motor, suction fan, and filter bags are all completely enclosed in an insulated cabinet, mounted on rubber feet to insure quiet operation. This attachment is available in two sizes for wheels up to 10 inches in diameter with 1 1/2-inch faces, and for wheels from 10 to 14 inches in diameter with 3-inch faces. ..... 60

## Leeds & Northrup Automatically Controlled Carburizing Furnace

A carburized case of any required depth within the carburizing range can be obtained uniformly and rapidly with the Homocarb furnace recently brought out by the Leeds & Northrup Co., 4921 Stenton Ave., Philadelphia, Pa. This equipment has separate and fully automatic controls for temperature and for the amount of carburizing medium, which permits the operator to vary any of the factors while holding the rest constant. In this way, improvements can be made in successive batches of work until an ideal case structure has been obtained.

The parts are placed in the furnace without being packed, since they are simply exposed to the Homocarb gas. Large parts are loaded either in the furnace basket or on fixtures. Small parts are simply dumped into the basket or into trays. A high-pressure fan located immediately below the work forces the gas at full carburizing temperature into every crevice of the load and to every surface of every piece. The equipment consists of the Homocarb furnace proper and the Micromax recording controller on a panel with other control accessories. A separate cooling unit is supplied for applications requiring slow cooling from carburizing temperature. ..... 61



Automatically Controlled Leeds & Northrup Homocarb Equipment

## Moline Precision Boring Machine

The Moline Tool Co., Moline, Ill., has recently added to its line a No. 116 FB multiple-spindle precision boring machine equipped with automatic electric push-button control of the hydraulic feed cycle. Hydraulic clamping of the work is also provided, so that the complete cycle, consisting of clamping the work in the fixture, performing the boring operation, withdrawing tools, and unclamping the work, can be accomplished automatically by simply pressing a button.

The particular machine shown is equipped for operation in this manner, boring four cylinder sleeve linings for internal combustion engines

Moline Precision Boring Machine with All Rotating Parts Enclosed Except the Automatic Retracting Heads

simultaneously. The cylinder sleeves are clamped by the hydraulically actuated toggle mechanism, which raises them against the top plate of the fixture. The sleeves are actually held in place by spring pressure exerted under each clamping member, and they remain securely clamped in position even though the hydraulic pressure is released, since the toggle mechanism is carried past the dead center position by the clamping movement.

Automatic unclamping of the work occurs only when the boring cycle has been completed. However, the tools can be withdrawn from the bores and returned to their starting positions before the operation is completed by pressing the button which starts the rapid traverse movement. This arrangement permits inspection of the bores at any time without disturbing or unclamping the work. If necessary, the work can be unclamped before the boring operation is completed by pressing a button. This button is operative only when the tools are withdrawn from the work.

The spindle is driven by a 7 1/2- or 15-H.P. motor having a speed of 1200 or 1800 R.P.M. The hydraulic unit is driven by a 3-H.P. motor having a speed of 1800 R.P.M. The maximum stroke provided by the hydraulic cylinder is approximately 30 inches. The machine requires a floor space of 7 by 4 feet and is 10 feet 10 inches in height. ..... 62



**To obtain additional information on equipment described on this page, see lower part of page 180.**

## Kux-Lohner Die-Casting Machines and Plastic Tablet Preforming Machine

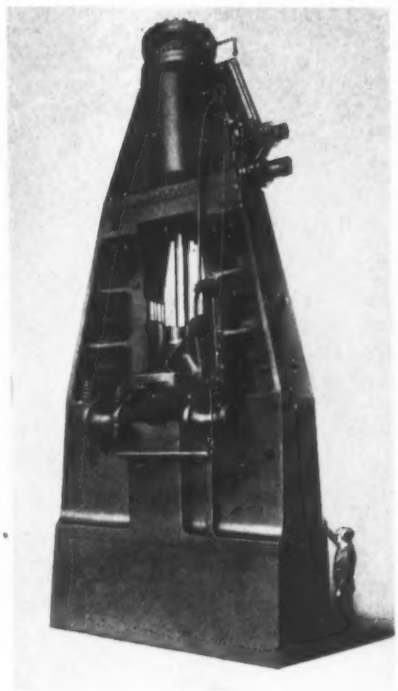
A Model BH hydraulically operated die-casting machine with several improved features has been brought out by the Kux-Lohner Machine Co., 2147 Lexington St., Chicago, Ill. This machine is built in four sizes for casting lead- or zinc-base metals, the width between the bars ranging from 12 to 24 inches. The machines are designed to withstand high injection and locking pressures, the frames being of heavy welded steel construction, while parts subjected to wear and strain are made of heat-treated alloy steels.

The gooseneck is supported in the melting pot in such a manner that no casting pressures are communicated to the furnace or the pot. These machines are furnished as complete self-contained units, including a motor-driven hydraulic pump.

The controls for the machines are designed to obtain simplicity and safety of operation. Each phase of the casting cycle must be completed before the next one starts, interlocking valves being employed so that the operations must be performed in their proper sequence. The machines can be furnished either manually controlled or with an electric timing device for controlling the "shot" time, which can be set to give any desired cooling period.

Another new machine recently brought out by the same company is the Model 3-CS six-punch rotary tablet press, which weighs 16,000 pounds and is believed to be the largest of its type ever constructed. This machine is built for the high-speed automatic production of large-size preformed plastic tablets. When set for producing preforms of the maximum size, which is 3 1/2 inches in diameter with a 4-inch fill, this press will produce 7200 tablets an hour, consuming approximately 3600 pounds of plastic material.

The rugged massive construction of this press makes it possible to safely employ pressures up to 100 tons. Although intended primarily for the production of relatively large preforms, the machine can be easily adjusted for smaller size tablets. An overload release device relieves any excess pressure. ..... 63



Chambersburg 20,000-pound Steam Drop-hammer Built for Forging Aircraft Crankshafts in Great Britain

## Chambersburg 20,000-Pound Steam Drop-Hammer

A steam drop-hammer of huge proportions for forging aircraft engine crankshafts, has recently been completed by the Chambersburg Engineering Co., Chambersburg, Pa., for the Sheffield (England) Works of Ambrose Shardlow, Ltd. The total weight of this hammer is close to 700,000 pounds, the weight of the anvil alone being about 50,000 pounds.

The most interesting points in the design of this hammer are the operating valve and the steam cylinder with unbalanced porting. The advantages claimed are:

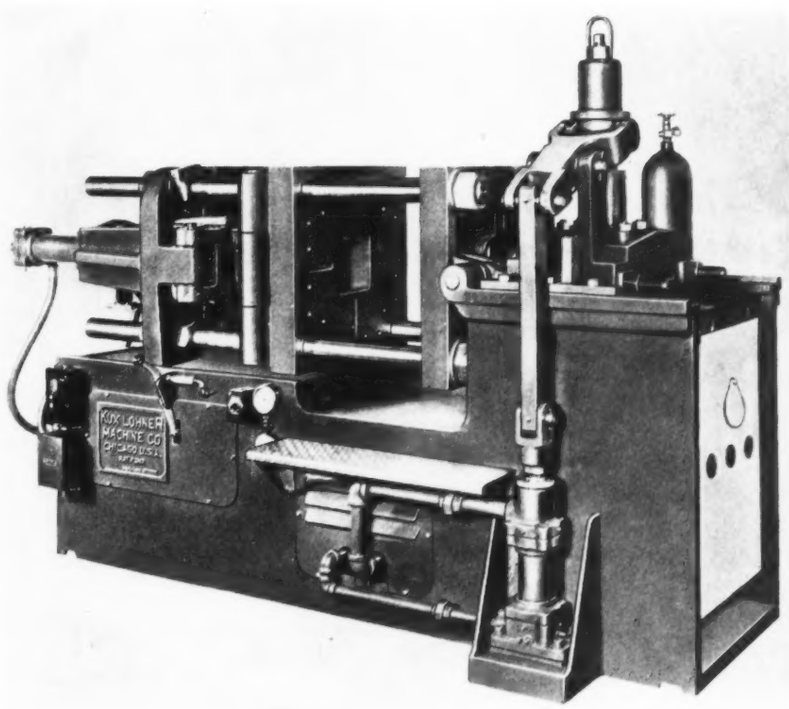
1. Little energy is required to accelerate the falling ram, as the back pressure under the piston is avoided. The return of the ram is fast, because of the large lower cylinder inlet. The building up of back pressure above the piston assures strong blows and protects the cylinder cover.

2. Leakage losses are avoided, due to elimination of the wear common to the round piston type valve. Adjustment for wear is rarely necessary. In more than two years' operation, properly lubricated surfaces have never required adjustment.

3. Sensitive control is insured by the perfect steam balance and freedom from appreciable friction.

4. The valve chamber is readily maintained tight, being subjected only to exhaust pressure. The valve distributes the steam or air to the cylinder internally. The valve chamber covers can be removed and the valve observed in action.

5. Greater strength is inherent in the form of cylinder used than in the conventional type. ..... 64




Kux-Lohner Die-casting Machine Built in Four Sizes

To obtain additional information on equipment described on this page, see lower part of page 180.

## Doall Grinder with Interchangeable Surface and Cutter Grinding Heads

The Doall Co., 1301 Washington Ave., S., Minneapolis, Minn., has recently brought out a machine that is available either as a precision surface grinder or as a universal cutter grinder. The same basic unit with a ball-bearing work-table is used for both the cutter grinding and the surface grinding machines. One machine can be furnished with interchangeable heads that permit changing over quickly from one operation to the other. The equipment not in use can be stored in a place provided for it in the base of the machine.

The surface grinder head has a 1-H.P. in-built motor, and the spindle is so mounted that it can be set at any angle up to 30 degrees. The spindle will accommodate wheels up to 7 by 1/2 by 1 1/4 inches. The back edge of the wheel cover forms a reflector which carries a 9-inch tubular "fluorescent" lamp which gives off a cold light that is directed on the work. This cold light eliminates the possibility of distorting the work by heat from the lighting medium. The chuck is of the permanent magnet type.

To set up the machine for cutter grinding, the special Dumore head is attached and the compound table is placed on the top of the work-table. The available cutter-grinder spindle speeds range from 5700 to 35,000 R.P.M. The wheel sizes range from 3/16 inch to 4 inches in diameter. Infinite planes of full circle movement of the wheel head facilitate sharpening a great variety of tools and cutters.

The work range of the machine is 6 by 16 by 12 inches. It occupies a floor space of 36 by 36 inches; the over-all size is 36 by 62 by 66 inches; and the weight 1800 pounds. 65

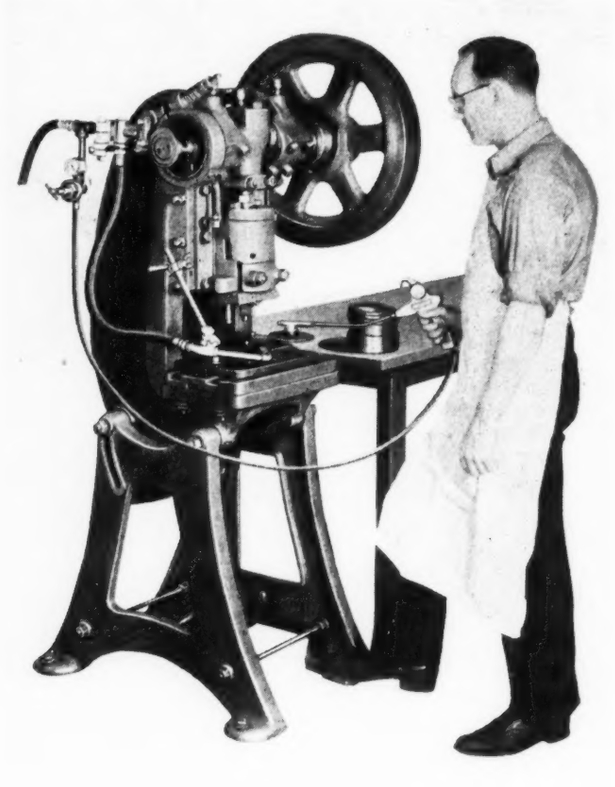
## Littell Safety Press Feeding Devices

Materials of various kinds can be easily picked up and fed into punch presses without bringing the hands within the danger zone by employing a "Pres-Vac" safety feeder in the manner shown in the illustration. This patented device is one of a new line of safety feeders and pickers recently placed on the market by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill. The device has a pistol-grip handle, and a single- or double-vacuum cup which is operated by the compressed air line and controlled by a trigger. The vacuum cup is attached to an extension of sufficient length to insure the safety of the operator, and is made in various sizes to suit the work.

This type of feeder can be used for picking up miscellaneous materials, including sheet steel, brass, aluminum, and even glass. It will pick up work having a wet, dry, or oily surface. A double-cup feeder can be used for handling material having a hole through its center. The exhaust air coming from the tip of the feeder can be utilized to blow chips or dirt from the die.

Other types of equipment known as mechanical pickers are included in the new line of feeders for picking up material that is not adapted for handling with a vacuum lift. These pickers are air-operated, and can be fitted with various types of jaws to suit the work handled, aluminum jaws being used to prevent damage to the dies. 66

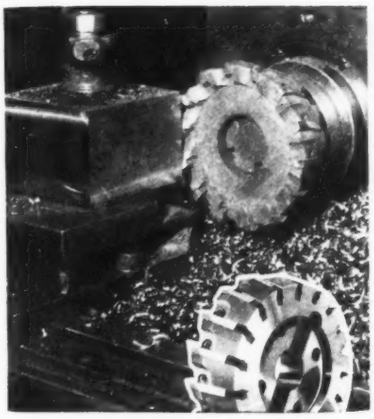
Doall Surface Grinder that can be Furnished with Interchangeable Cutter Grinding Head Shown in Upper Views



"Pres-Vac" Safety Feeder Used to Pick up and Feed Materials without Bringing Hands into Danger Zone



To obtain additional information on equipment described on this page, see lower part of page 180.



McCrosky Kennametal-tipped Shell End-mill in Operation

## McCrosky Kennametal-Tipped Blade Milling Cutters

A series of milling cutters with Kennametal-tipped blades has been developed by the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., in cooperation with the McCrosky Tool Corporation, Meadville, Pa. In the illustration is shown a 7-inch diameter McCrosky jack-lock shell end-mill tipped with Kennametal, Grade KM, milling S A E 4150 steel forgings which have been heat-treated before machining to a hardness of from 28 to 32 Rockwell C. The cutter runs at 92 R.P.M. The feed is 3 5/8 inches per minute, and the depth of cut 0.125 inch. On an average, 160 forging faces are milled before regrinding.

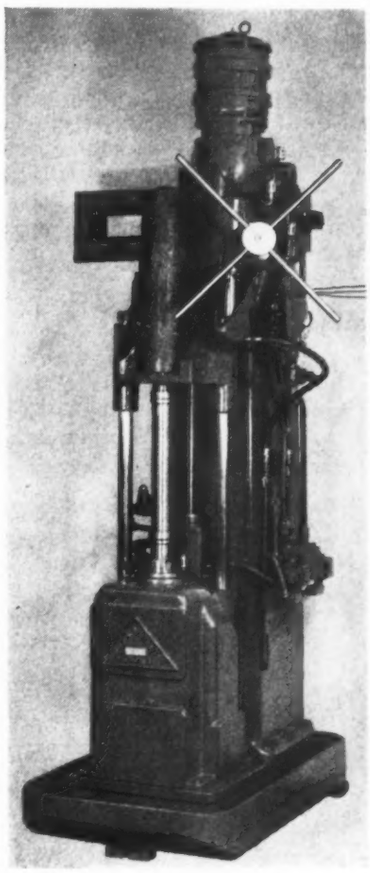
The new series comprises nine standard sizes in each of the following types of cutters: Medium-duty face mills, heavy-duty face mills, and shell end-mills. Incorporated in all these milling cutters is the jack-lock wedge developed by the McCrosky Tool Corporation, which holds the blades with great rigidity. Accurate adjustments are possible, as the blades can be moved forward as little as 0.002 inch at a time. 67

## LeMaire Shell-Centering Machine

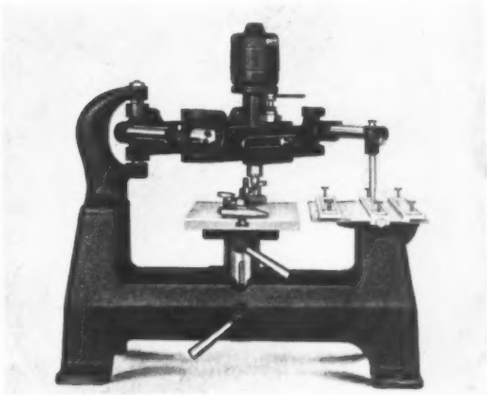
The LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich., has developed a shell-centering machine which is intended primarily for the first operation, holding the shell from the rough-forged hole on an arbor by means of two sets of three expanding locators. It can also be used for recentering operations, locating the work in the same manner from the bored hole.

The outstanding feature of this machine is the inverted spindle for rotating the shell or performing the centering operation. This arrangement insures concentricity of the center with the hole in the shell. By rotating the shell in a vertical position, any tendency for it to wabble, such as would occur if it were mounted in a horizontal position, is eliminated. The elevating platform lowers the shell over the arbor to facilitate loading. The uppermost position of the platform is on a level with the conveyor, where the shell is easily transferred to the platform. All movements are obtained by hydraulic power, except the operation of cutting the center which is done manually.

The machine shown is used in centering a 6-inch shell. With slight modifications, it can be used for other sizes. The machine can be furnished without the elevating platform for centering smaller shells, such as the 75-millimeter size. 68



LeMaire Shell-centering Machine



Preis Bench Type Pantographic Machine with Engraving Head in Place

## Preis Combination Engraver and Etcher

A new bench type pantographic machine for performing general industrial engraving work on a variety of materials, supplied with a separate head for electric etching on soft or hardened steel, has been brought out by the H. P. Preis Engraving Machine Co., 157 Summit St., Newark, N. J. The engraving and etching heads can be quickly interchanged.

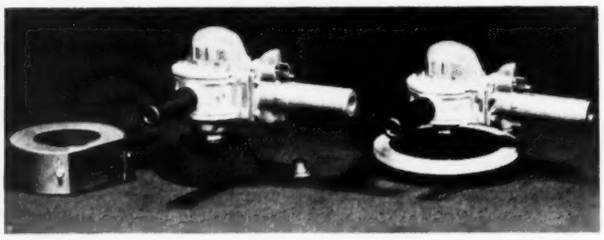
For engraving work, the depth of cut is controlled independently of the depth of the master character by a micrometer adjustment mechanism on the engraving head. Movement of the engraving cutter, to and away from the work, is controlled by a cam-action drop-lever which eliminates the necessity for raising and lowering the pantograph. Either raised or sunk engraving can be produced. For engraving on uneven surfaces, on slightly concave or convex surfaces, or on objects varying in thickness, the depth of cut is automatically controlled.

For electric marking, contact of the etching point with the work is controlled by a sensitive spring pressure. The etching point can be removed from the fixture and used as a hand etching pencil for rough and free-hand marking. An electrical transformer provides three or more voltage stages for various depths of marking. Electrical connections can be made by plugging into any light socket. 69

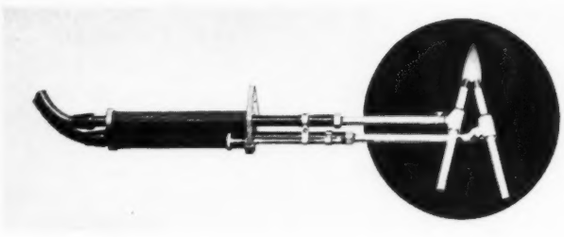
## Photo-Electric Limit Switch

Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass., has recently added to its line of controls an "electric

To obtain additional information on equipment described on this page, see lower part of page 180.



Rotor Air Grinders Equipped with Cup-wheel and 9-inch Pad, Respectively. Guard is Shown at Left



Marquette Arc Torch with Easily Controlled Flame for General Heating and Preheating Work

eye" limit switch designed to reduce the maintenance cost of limit switches employed in the heavier industries. This low-cost control is a simplified photo-electric unit of rugged construction. It is suitable for installation where exacting conditions of vibration, humidity, and temperatures are encountered.

The Type A14B limit switch is supplied with a light source in weather-proof housings suitable for installation in any location. The Type A20C limit switch operates directly from light given off by red-hot metal of any shape. No light source is required, and the hot objects may vary in their location relative to the control. It provides limiting control, operates reversing rollers, conveyors, etc., or counts objects. ..... 70

## Rotor Vertical Air Grinders

The Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio, has brought out two vertical types of air grinders known as B-1X and B-3X. The power of both models has been increased over 40 per cent as compared with preceding types. They are capable of high speed under load; the maximum power is developed with less than a 10 per cent drop in the free speed. The B-1X model weighs 10 pounds, and the B-3X, 12 1/2 pounds.

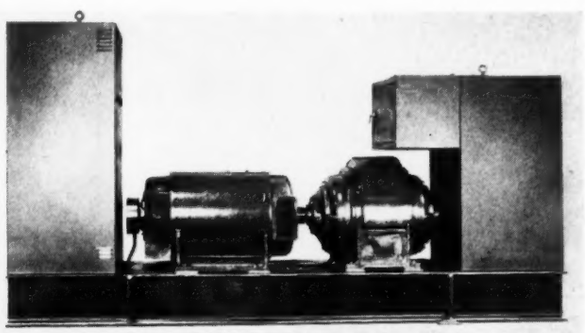
A balanced governor is incorporated that controls the maximum speed within the limits of the standard Safety Code by compressed spring action, which is not affected by variations in air pressure.

Both models are used for grinding welds, castings, etc., with 6- by 4- by 5/8-inch cup-wheels. They are also employed with a 9-inch flexible pad for disk-sanding, or with a 6-inch cup brush for wire-brushing. In addition, they can be used for the rapid surfacing of hard stone by using a stone wheel operated at 5000 R.P.M. ..... 71

## General Electric Multiple-Operator Welding Sets

The General Electric Co., Schenectady, N. Y., has redesigned its 1500-ampere, constant-potential, arc-welding sets for multiple-operator and machine welding to obtain more compact construction, lighter weight, improved appearance, and easier installation and operation. These motor-generator sets are especially adapted for supplying the heavy current demands of modern automatic welding and the exacting requirements of production hand-welding by a number of operators. As the average hand-welding operation is not continuous, the use of one large machine capable of supplying a number of welding stations of a given connected load is more economical than the use of a separate welding set at each station.

These welding sets are equipped with standard driving motors for operation on direct current or on polyphase alternating current of any commercial voltage. Synchronous driving motors can be used to help keep power costs at a minimum. ..... 72



General Electric 1500-ampere Arc-welding Set for Multiple-operator Use

## Marquette Arc Torch

For users of electric welding equipment who need an independent source of heat, such as is supplied by a gas torch for many heating and welding jobs, the Marquette Mfg. Co., Minneapolis, Minn., has brought out an arc torch operating on alternating welding current. This equipment makes it possible to perform general heating jobs; preheating; welding of aluminum, bronze, copper, German silver, and other nonferrous metals; brazing; soldering; and hard-facing.

Less current is required for operating the arc torch than for welding with the metallic arc. The torch can be used with any alternating-current machine. Its easily controlled "flame" is especially suited to such jobs as welding aluminum. Frames, bumper brackets, and similar parts can be heated for straightening. Hard solders and silver solders can be successfully handled, making it particularly applicable to the repair of copper, brass, and Monel metal, as well as ferrous materials. ..... 73

## Micro Switch Actuator

A complete roller lever actuator, designed as an attachment for regular and "metal-clad" switches, has been brought out by the Micro Switch Corporation, Freeport, Ill. This actuator (the Type J) can be readily attached to the switch, is easy to adjust, and is constructed for long service.

The lever arm rides on an oilless bronze bearing, which rests on the plunger of the switch. A case-hardened roller with an oilless bronze bearing is mounted on the end of the lever arm. The operating ratio is about 8 to 1, so that a movement of 0.008 inch at the end of the



To obtain additional information on equipment described on this page, see lower part of page 180.

lever arm moves the switch plunger 0.001 inch. A pressure of 2 ounces at the end of the lever arm will exert a pressure of 16 ounces at the actuator point. ..... 74

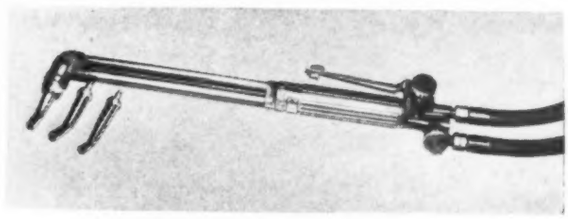
## Vandenwood Desk Type Blueprinting Machine

A new blueprinting machine has been brought out by the Vandenwood Co., 2900 Euclid Ave., Cleveland, Ohio, under the trade name "Baby Blue Desk Unit." The unit prints black and white prints, as well as blueprints up to 10 by 18 inches. A tubular lamp guaranteed for 1500 hours operation insures an even distribution of light for printing. The unit is only 34 inches long, 8 inches wide, and weighs 15 pounds. ..... 75

## Wire Insulation Stripper with Vacuum Collector

A power-driven, brush type wire stripper known as the "Ideal 9-C" model is being marketed by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. This unit is designed to speed up production work in stripping cotton and enamel, silk and enamel, string asbestos, and other insulations from round, flat or rectangular solid or stranded wires. It is especially effective in cleaning fine "litz" wires, in removing gummy insulation embedded in stranded wires, and in cleaning magnet wire. Uniform length of stripping is obtained by a stop adjustment knob.

There is a vacuum attachment which draws the insulation material into a drawer in the base of the unit, thus eliminating the dust and dirt resulting from stripping operations. The special steel wire brushes used in the stripper are driven by a 1/4-H.P. motor. ..... 76



Special Oxweld Nozzles Designed for Gouging Operations with Medium-pressure Cutting Blowpipe

Spline Nut with "Elastic Stop"

## Oxweld Nozzles Designed for Oxy-Acetylene Gouging

A series of new oxy-acetylene gouging nozzles for use with a standard hand-cutting blowpipe, such as the Oxweld C-32, has been brought out by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City. These nozzles, available in three sizes, provide a means for quickly and accurately removing a narrow strip of surface metal from strip plate, forgings, and castings.

By proper manipulation of the blowpipe, in which the nozzle has been inserted, a smooth, accurately defined groove can be gouged out of the surface of the metal. The grooves can be easily varied in width and depth by using different sized nozzles, for gouging the under side of electric welds; removing weld metal, such as temporary tack-welds and defective welds; preparing plate edges for welding; and performing maintenance and scrapping operations, as well as metal shaping and trimming processes. ..... 77

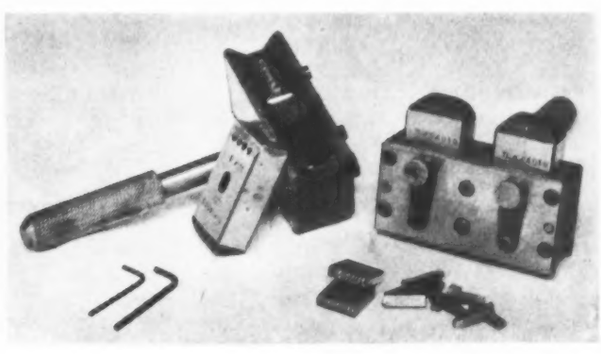
## Elastic Stop-Nuts

The Elastic Stop Nut Corporation, 1015 Newark Ave., Elizabeth, N. J., has recently added nine new types of nuts to its line, all of which embody the basic "Elastic Stop" self-locking element, which consists of a resilient non-metallic collar built into the head of the nut. This collar, in resisting the entrance of the bolt or screw, forces the thread faces into a pressure contact, which is maintained after the nut is tightened. With thread play thus eliminated, the nut cannot work loose under vibration, operating stresses, or wear of the surrounding parts. With variations in sizes, thread systems, and materials, the entire line now includes one hundred sixty different types of nuts. ..... 78

## Universal Marking Device for Round Shafts

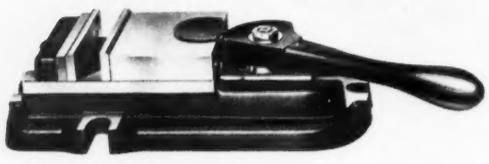
A universal marking device that permits lengthwise marking directly on the cylindrical surfaces of shafts, rods, etc., has been brought out by New Method Steel Stamps, Inc., 143 Jos. Campau St., Detroit, Mich. The device consists of a floating type retainer for the type, and a guide-holder designed for the use of either solid or individual type. As shown in the illustration, the bottom of the guide holder has a wide V-shape, so proportioned that the sides of the V-guide will rest against any round shaft, thus providing a support on both sides, so that the type is accurately aligned on the center of the shaft, as required for clear marking. ..... 79

"Ideal" Brush Type Wire Stripper for Removing Insulation Windings



Shaft Marking Device Made by New Method Steel Stamps, Inc.

To obtain additional information on equipment described on this page, see lower part of page 180.



Quick-acting Cam-operated Vise Made by Brown & Sharpe Mfg. Co.

## Brown & Sharpe Cam-Operated Vise

The Brown & Sharpe Mfg. Co., Providence, R. I., has added to its line of machine vises a new No. 1C cam-operated model designed to insure fast, strong, and reliable gripping of duplicate pieces that do not vary in size more than the clamping movement of the movable jaw, which is about 1 3/4 inches.

This vise has a fixed jaw attached firmly to the mid-section of the body. The movable jaw at the end of the vise has a tongue that extends under the fixed jaw. The cam pivot is clamped to this tongue. When the nut on the pivot is loosened, the position of the pivot can be adjusted lengthwise on the tongue. Mating serrations on the pivot base and tongue firmly lock the pivot in place when the nut is tightened. The cam which turns on the pivot works against the fixed jaw, causing the pivot and movable jaw to advance or withdraw by its movement. A pin in the vise body moves in a groove in the cam, providing positive release.

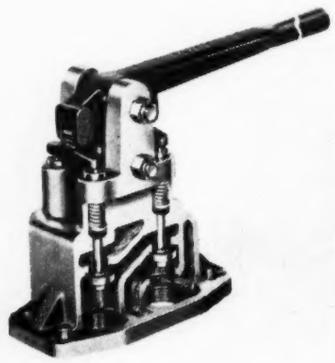
Tongue slots at right angles permit the vise to be set either lengthwise of the table or at right angles to it. Reversible tongues for either 11/16- or 13/16-inch T-slots are furnished for use on any table having corresponding T-slots. The width of the jaws is 4 1/8 inches; depth, 1 1/16 inches; and height, 3 1/16 inches. 80

## General Electric Weld Recorder

Because the numerous variables affecting the quality of spot-welds are not under constant control, the General Electric Co., Schenectady, N. Y., has developed a weld recorder to indicate these variations. This instrument acts as a recording device, signaling device, and control, which measures the electrical input to the welder for each spot-weld.

The new weld recorder is so designed that when the electrical input to the welder varies sufficiently to produce a defective weld, a bell gives a continuous audible signal and the weld-initiating circuit is automatically opened, preventing subsequent welding until a push-button is pressed. In addition, the recorder chart shows that the weld was not made within the preset allowable limits; it also shows whether the heat was above or below normal.

Forty of these new General Electric weld recorders are now used by the Edward G. Budd Mfg. Co., Philadelphia, Pa., to avoid faulty welds in the "shot-welding" of airplane fuselages and railroad car structures. 81



Ross Air-control Valve Designed for Heavy Duty

## Ross Heavy-Duty Air-Control Valve

A new heavy-duty, hand-operated, air-control valve has been brought out by the Ross Operating Valve Co., 6494 Epworth Blvd., Detroit, Mich., which, like other Ross valves formerly described in MACHINERY, is of the poppet valve type. However, the mounting flange, uprights, lever, and other parts of the new valve are much heavier than on valves of the company's standard line. The mounting dimensions, pipe connection locations, and bolt-holes remain the same.

Special alloy lever and rocker-arm pins of larger diameter, fitted with needle type roller bearings, larger stuffing boxes, and stainless-steel poppet stems and retainers provide the new valve with extra strength and wear resistance. 82

Ingersoll-Rand "Oil-ir" Air-Line Lubricator

## Ingersoll-Rand Air-Line Lubricator

An air-line lubricator known as the "Oil-ir," which is capable of operating in any position, has been brought out by the Ingersoll-Rand Co., 11 Broadway, New York City. While designed primarily for rock-drill lubrication, it can be used on many kinds of air-operated tools. Adjustment of the oil feed can be made without taking the pressure off the chamber or interrupting the work. The lubricator will not "syphon back" or leak when the air pressure is released. It can be filled in either a vertical or horizontal position. 83

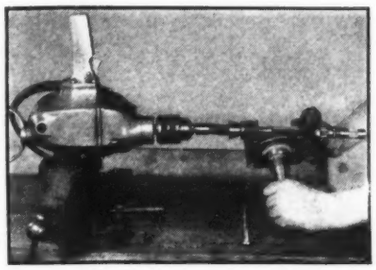
## Essco Portable Tool Stand

A portable tool stand for all classes of shop work has been placed on the market by the Metal Products Division, Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia, Pa. This stand is 24 inches wide by 18 inches deep, and has a height of 32 inches, including the casters, which are of the 2 1/2-inch swivel type. A drawer is provided, the inside dimensions of which are 17 inches wide, 15 3/4 inches deep, and 5 inches high. The stand is finished in olive-green enamel. 84

Essco Portable Tool Stand



To obtain additional information on equipment described on this page, see lower part of page 180.



Ammco Small-bore Hone in Operation

## Ammco Small-Bore Hone, and Bearing Boring Machine

A small-bore hone for piston-pin fitting, honing spindle bolt bushings, water pump bushings, and steering sector bushings, as well as honing brake cylinders and other small bores requiring accurate mirror finish bearing surfaces, has been placed on the market by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill. This hone has an automatic centering cone, push expansion knob, and stop-collar. It is made in two sizes with capacities for holes ranging from 47/64 inch to 1 5/16 inches in diameter and 1 inch to 1 5/8 inches in diameter.

The same company has also brought out a bearing boring machine for sizing and finishing connecting-rod and main replaceable bearings. This precision machine is so designed that insert bearings within a range of 1 5/8 to 3 1/2 inches in diameter up to 4 inches in length can be accurately bored to any size. It can also be used for the accurate boring of sleeves, bushings, and small cylinders, as well as split bearings. 85

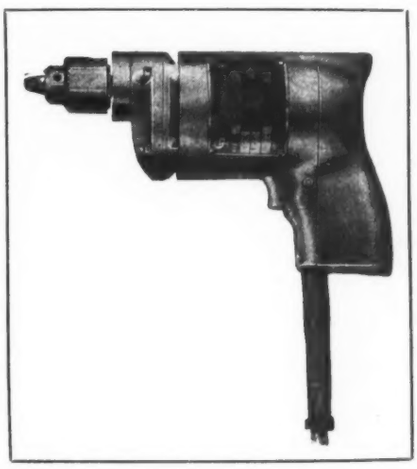
## Upton Electric Salt Bath Furnace

An electric salt bath furnace capable of handling practically any heat-treating work involving temperatures from 250 to 2500 degrees F. has been brought out by the Commerce Pattern Foundry & Machine Co., 2211 Grand River Ave., Detroit, Mich. This furnace can also be used as a heating device for brazing assemblies, heating before forging, etc.

The salt bath furnace operates on the principle of continuous electric current flow, the rate of which varies instantaneously to offset temperature fluctuations. Temperatures can be maintained up to 2500 degrees F. with accuracies within the limits of pyrometric measurements; in other words, the furnace itself serves as a pyrometer, calling for or refusing electric power as the temperature fluctuations dictate. 86

## Universal Electric Drill

The Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, has brought out a new line of universal electric drills, screwdrivers, and nut-runners. The special features of the new streamline drill are compactness and unusual resistance to wear and abuse. It has a capacity for drilling holes up to 1/4 inch in diameter in metal or wood. The motor is of unusually high torque, and is available in three speeds. The gear-case contains but one pair of helical gears. The ball bearings are mounted in steel inserts.



Universal Electric Drill Made by the Chicago Pneumatic Tool Co.

The housings of these tools are designed to resist rough usage; a blow on the handle, for example, cannot distort the bearing alignment, since there is no connection between the handle and the bridge that supports the rear armature bearing. The air intakes are at the ends of the handles, where they will not be covered by the hand or pick up dirt and chips.

There are no screens, the castings being perforated with very small holes. The switch is an over-size two-pole enclosed mechanism, with a die-cast close-fitting trigger attached. The tool, when supplied as a screwdriver, has a capacity for driving No. 8 wood screws or 3/16-inch machine screws. When equipped as a nut runner, it will handle 3/16-inch nuts or bolts. 87

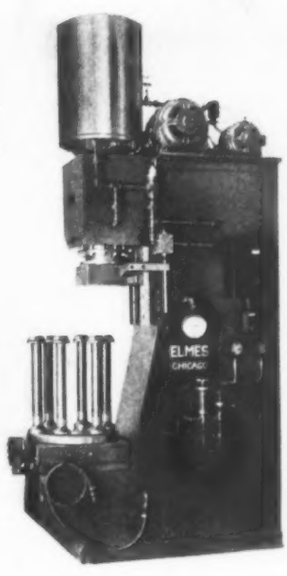
## Improved "Magne-Gage" for Measuring Metallic and Non-Metallic Coatings

The "Magne-Gage" made by the American Instrument Co., 8010-8020 Georgia Ave., Silver Spring, Md., which has previously been described and illustrated in the technical press, has recently been improved, so that only one instrument is now required to measure various types and thicknesses of coatings. The broadening of the scope of this instrument is made possible by simply interchanging different types of magnets. The improved instrument is adapted for measuring the thickness of magnetic coatings on non-magnetic-base metals; non-magnetic metallic or non-metallic coatings on magnetic-base metals; and nickel coatings on iron or steel. 88

## Elmes Metal Marking Press

A new versatile hydraulic metal marking press has just been brought out by the Charles F. Elmes Engineering Works, Chicago, Ill. This press will die-stamp any marking on metal pieces of a wide range of sizes and shapes, and is capable of twenty markings per minute.

The operation is fully automatic and is controlled by push-buttons. There are six stations on the turntable. The table and ram can be moved independently of each other. The machine is so arranged that it




Elmes Hydraulic Metal Marking Machine

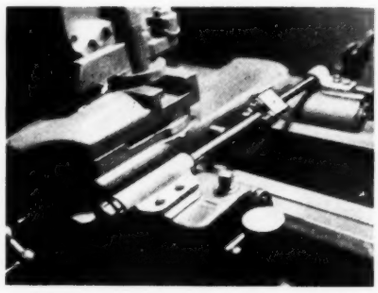
To obtain additional information on equipment described on this page, see lower part of page 180.

will not stamp a blank mandrel. The pressure can be released at a predetermined tonnage or after the die has marked the work to a specified depth.

The range of pressure is controllable from 15 to 100 tons. The machine is of all-steel construction and has an over-all height of approximately 11 feet. It includes motors, starters, and accessories, ready for operation. ..... 89

## Portman Multiple-Diameter Lathe Stop

A device to insure the accurate duplication of parts turned on an engine lathe has been brought out by the Portman Machine Co., 2236 Bathgate Ave., New York City. This attachment can be fitted to the wings of the carriage of any lathe, as shown in the accompanying illustration, and consists of an indexing head, a four-way cross-slide, and a rear bearing support.



Portman Multiple-diameter Stop Applied to Lathe

In operation, after a piece of work has been turned to the various diameters, the set-screws on the cross-slide are set in position, and duplicate pieces can then be turned without continuous measuring of diameters. This device is made in several sizes to fit all lathes from bench models to large floor machines. ..... 90

## Etching Solutions for Microscopic Examination of Metals

A number of metal etching solutions containing glycerine are given in an article by Dr. B. Egeberg and N. E. Promisel in *Metal Industry*. For etching aluminum and its alloys, it is recommended that the freshly polished, cleaned specimen be warmed in hot water and immediately treated with an etching mixture made from one part of nitric acid, two parts of hydrofluoric acid, and three parts of glycerine.

White metals such as tin, lead, antimony, bismuth, and their alloys, as well as Britannia metal, can be etched with a solution consisting of one part nitric acid, three parts acetic acid, and fifteen parts of glycerine. After being etched, the specimens, in all cases, are rinsed in hot running water and dried by an air blast.

* * *

## Honoring Men of Long Service

The General Electric Quarter Century Club recently gave a dinner in honor of 159 employes of the General Electric Co. who are still actively employed in the Schenectady Works after at least forty years' service. Among those present was C. J. Leephart, who has been in the company's service for fifty-six years. Four other men with a fifty-year service record were also present.

* * *

## How Jobs are Created

Since 1879 no less than fifteen major manufacturing industries have developed out of scientific research. What they mean to our economy can best be measured by imagining where we would be without them. It has been estimated that these fifteen industries have created, directly and indirectly, no fewer than 15,000,000 new jobs.—*United Effort*

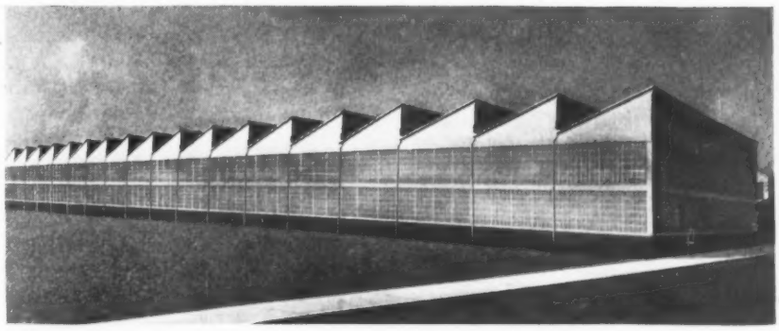
Specially Designed Cabinets, Mounted on Wheels, that Serve Both as Delivery Trucks and Storage Bins, are Used in the Shops of the Monarch Machine Tool Co., Sidney, Ohio, to Handle Dozens of Small Parts that Must be Continuously Supplied to the Men on the Small-lot Sub-assembly Lines. These Trucks are Loaded in the Stock-room and Wheeled to Their Positions beside Work-benches in the Shop



To obtain additional information on equipment described on this page, see lower part of page 180.

# Landis Tool Co. Holds Open House in New Erecting Shop

THE Landis Tool Co., Waynesboro, Pa., held Open House December 2 and 3 in its newly completed erecting shop which covers an area of 125 by 450 feet. More than 10,000 people visited the plant during the two days. An exhibit was arranged in the new shop, showing the earliest and the most recent Landis grinding machines. In addition, there was a unique series of exhibits showing how machinery of all types has reduced the cost of consumers' goods and brought within the reach of everybody articles that were formerly considered luxuries—or that in many cases were not obtainable at all, since they are the direct results of new inventions, the manufacture of which has been made possible by the machine.



The New Erecting Shop of the Landis Tool Co., which Has Walls almost Entirely of Steel and Glass

The new shop building has walls consisting almost entirely of glass and steel. It is equipped in the most modern manner throughout, many features being unique in machine shop construction. One of these is the arrangement used for paint-spraying the grinding machines. This installation is the largest of its kind in the United States. The fumes and paint are drawn downward by suction fans to a pit below, where the paint is separated from the fumes, the latter being carried to the top of the building on the outside. This arrangement makes it unnecessary for the workmen to wear masks while spraying.

Artificial light is furnished by 170 lights of 1000 watts each, suspended from the ceiling and providing 42 foot-candles of lighting at working height over the entire building area. This makes it one of the best illuminated machine shop buildings in the country. The glass walls are made from 17,000 sheets of light-diffusing glass, ribbed both horizontally and vertically, so that the light is thoroughly diffused.

The heating is provided by twenty-seven unit heaters sufficient to keep the building at 80 degrees F., if this were desired, with a gale blowing and the outside temperature at 10 degrees below zero. In order to provide uniform heat throughout the day, the heaters are automatically controlled by means of thermostats. The door for the railroad track that enters the shop is raised and lowered electrically. Here a unit heater is installed which operates as the door is raised, and stops automatically when the door is closed. The warm air from the heater prevents cold air from entering the doorway.

Interior View of One End of the New Glass-walled Erecting Shop of the Landis Tool Co. Photograph Taken During the Open House Celebration on December 3

* * *

## Securing America's Industrial Future

America faces a period of keen competition with other countries where necessity has driven men to prodigious efforts in the search for new and substitute materials, lower costs of production, and expanding markets. Habits of industry and hard work have been developed abroad, and national programs have been unified. In America, much has been lost in morale, unity, and technical skill as a result of the depression, while at the same time there exists a false feeling of superiority to other nations. At present, more thought is given to short working hours, high wages, and social security than to the industrial developments that will assure these ends. The war abroad makes it imperative that American industry, and particularly our engineers, be prepared in the best possible manner for emergencies that may arise.—*From the Presidential Address by A. G. Christie before the American Society of Mechanical Engineers*

## Dexter S. Kimball, Distinguished Engineering Educator, Honored

Dexter S. Kimball, dean of the College of Engineering of Cornell University until he retired in 1936, distinguished as an engineer, teacher, and author of engineering books, has been awarded an honorary membership in the American Society of Mechanical Engineers. The formal presentation took place at the sixtieth annual meeting of the Society held in Philadelphia early in December.

Dean Kimball, who is a past-president of the Society, was honored because "besides having a lovable personality, high good humor, fine philosophy, and keen insight into men and affairs, he has made distinguished contributions to engineering progress and to public recognition of the profession of teaching and engineering."

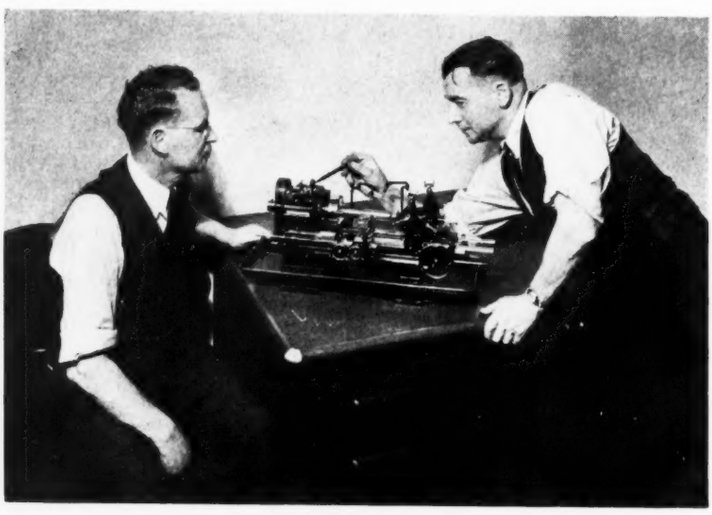
Dean Kimball graduated from Leland Stanford University in 1896, receiving the degree of Mechanical Engineer in 1913. He served a regular machinist apprenticeship, and later was employed for ten years in the shops and engineering departments of the Union Iron Works of San Francisco. He then became designing engineer for the Anaconda Mining Co. His practical experience also includes that of works manager of the Stanley Electric Mfg. Co., Pittsfield, Mass., later incorporated with the General Electric Co.

Since 1904, he was continuously with Cornell University, first as professor of machine design and industrial engineering, and from 1920, until he retired in 1936, as dean of the College of Engineering. Mr. Kimball was president of the American Society of Mechanical Engineers in 1922, and president of the Society for the Promotion of Engineering Education in 1928-1929. He has also been president of the American Engineering Council.

In 1933, he received the Worcester R. Warner medal from the Society of Mechanical Engineers and the Lamme medal from the Society for the Promotion of Engineering Education. He has also been given the honorary degrees of LL.D. by the University of Rochester; Doctor of Science by the Case School of Applied Science; and Doctor of Engineering by Kansas State College, Northeastern University, and Lehigh University.

## Unusual Model of Turret Lathe

A miniature Warner & Swasey turret lathe that is an exact replica of a full-sized machine, including a turret that indexes, a headstock with a complete range of adjustable speeds, and a miniature oil-pump that actually circulates coolant, was exhibited as part of the employe hobby show at the open house held by the company early in December. The model is the work of Paul H. Klamm, planer department foreman (seen to the right in the picture), who has been building models as a hobby for several years. The model is slightly more than 20 inches in length. Some of the apron feed-gears are only 1/4 inch in diameter.



A Model of a Warner & Swasey Turret Lathe, Hardly More than 20 Inches in Length

* * *

## Standardized Colors for Pipes

The standard approved by the American Standards Association in 1928, specifying colors to use on pipes carrying different types of fluids or gases, is not so well known as would be desirable. The use of standard colors helps to make the pipe easily recognized and to prevent mistakes in the case of an emergency.

According to this standard, red is used for pipes for fire protection purposes, sprinkler systems, etc. Yellow is used for pipes conveying dangerous materials, such as corrosive, inflammable, explosive, or poisonous gases and fluids. Green is used for safe materials, such as water. Blue indicates protective materials other than those intended for fire protection, such as poison antidotes and anti-corrosives. Finally, purple is used for pipe lines conveying very valuable materials, such as rare or expensive gases and liquids.

* * *

## Experimental Foundry to be Built by Armour Institute

The Research Foundation of the Armour Institute of Technology, Chicago, Ill., is building an experimental foundry to be located at 34th and Federal Sts., Chicago. This foundry will provide facilities for research in the production of iron and steel castings. It is to be used primarily in connection with the activities made possible by the Wetherill Research Fund recently established by Colonel S. P. Wetherill of Philadelphia, Pa. This fund was specifically established for the purpose of advancing the methods of die-casting iron and other high-temperature-melting metals.

* * *

The art of soldering goes very far back in history. The invention of this art is, according to *The Inventor*, credited to the Greek Glaucos, about 585 B. C.

# NEWS OF THE INDUSTRY

## Illinois

HANNIFIN MFG. CO., 621 S. Kolmar Ave., Chicago, Ill., manufacturer of hydraulic and pneumatic production equipment, has recently acquired the business of the ROCK RIVER MACHINE CO., Janesville, Wis., which company manufactures all types of vertical and horizontal punches and shears, combination punches and shears, splitting shears, bending rolls, bulldozers, bending and straightening machines, and stake riveters. The engineering, sales, and manufacture of the Rock River Machine Co.'s line will continue to be carried on in the Janesville plant. The addition of new related products is being contemplated.

RALPH M. HOFFMAN, vice-president and sales manager of the Link-Belt Co. Pacific Division, San Francisco, Calif., for the last eight years, has been appointed assistant to the president of the Link-Belt Co., with headquarters at the company's general office at 307 N. Michigan Ave., Chicago, Ill. Mr. Hoffman is a graduate mechanical engineer of the University of Minnesota, class of 1911. He went to the Link-Belt organization in 1923 as manager of the Seattle branch.

R. L. FORNEY, assistant to the managing director of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill., has been appointed director of the Council's Industrial Division, succeeding W. DEAN KEEFER, who has ended twenty-one years of service with the Council to become assistant to the vice-president in charge of safety engineering of the Lumbermen's Mutual Casualty Co.

JOHN S. BARNES CORPORATION, Rockford, Ill., has appointed W. H. BLACKMER, Larchmont, N. Y., sales engineer in the New England and metropolitan New York area. BRYANT MACHINERY & ENGINEERING CO., Daily News Bldg., Chicago, Ill., will sell Barnes hydraulic equipment in the Chicago territory.

SCIENTIFIC LUBRICANTS MFG. CO., 3462 N. Clark St., Chicago, Ill., has just celebrated its twenty-fifth anniversary. The company produces Motor Mica No. 711, an anti-friction lubricant used for electric motors, gears, power presses, printing equipment, etc.

M. R. CROSSMAN, of Madison, Wis., has joined the staff of the Machine and Small Tool Division of the Barber-Colman Co., Rockford, Ill. Mr. Crossman will handle all matters pertaining to advertising and publicity.

## Michigan

OMER L. ALLEN has been appointed superintendent of the foundry of the Pontiac Motor Division of the General Motors Corporation. Mr. Allen learned his trade as a molder in a gray-iron foundry in Logansport, Ind. In 1914, he became foreman of the Maxwell Foundry in Dayton, Ohio, and the following year he went to the Wilson Foundry & Machine Co., Pontiac, Mich., as foreman becoming, successively, general foreman, assistant superintendent, and superintendent. It was from the latter position that he left to join the Pontiac organization.

GEORGE J. CONNELLY has become production manager and chief engineer of the Covered Wagon Co., Mount Clemens, Mich., trailer coach manufacturer. Mr. Connelly is widely known in the automotive industry, having been connected with it as a production executive and body engineer for more than twenty years. Recently, he was division superintendent at the Packard Motor Co. Previous to that, he was general manager of the body division of the Hupmobile company.

PROGRESSIVE WELDER CO., Detroit, Mich., manufacturer of hydraulic welding equipment, has awarded to the Austin Co., Cleveland, Ohio, the contract for building a new plant at 3080 Outer Drive, Detroit, Mich. The initial unit will provide more than 27,000 square feet of floor space.

## New England

VAN KEUREN CO., Watertown, Mass., has moved into a new plant at 176 Waltham St., Watertown. The new plant will give the company increased facilities for the production of precision measuring tools, including gage-blocks, measuring wires, and plug gages. An air-conditioning heating system, with automatic temperature control and air filtration, has been provided to maintain uniform temperature and dust-free atmosphere.

V. WAYNE GREEN, manufacturers' representative, has opened an office at 623 State Mutual Bldg., 340 Main St., Worcester, Mass., to promote, throughout the New England states, the sale of the resistance welding equipment built by the Taylor-Winfield Corporation, Warren, Ohio. It was erroneously stated in November, 1939, MACHINERY, page 234, that this office had been opened by the Taylor-Winfield Corporation.

TURNER ENGINEERS, INC., 113 Clinton St., Springfield, Vt., has been formed to specialize in machine tool engineering and to carry out complete and detail designs, build models, and arrange for patents. Albert Turner, vice-president and treasurer, has had forty years of training in leading machine tool plants in the country.

LOUIS H. BRENDEL has been appointed assistant to C. H. Butterfield, general sales manager of the Manning, Maxwell & Moore, Inc., Bridgeport, Conn., makers of pressure gages, safety valves, globe valves, etc. Mr. Brendel's new duties will include the supervision of sales promotion and jobbers' relations for various lines of the firm's products.

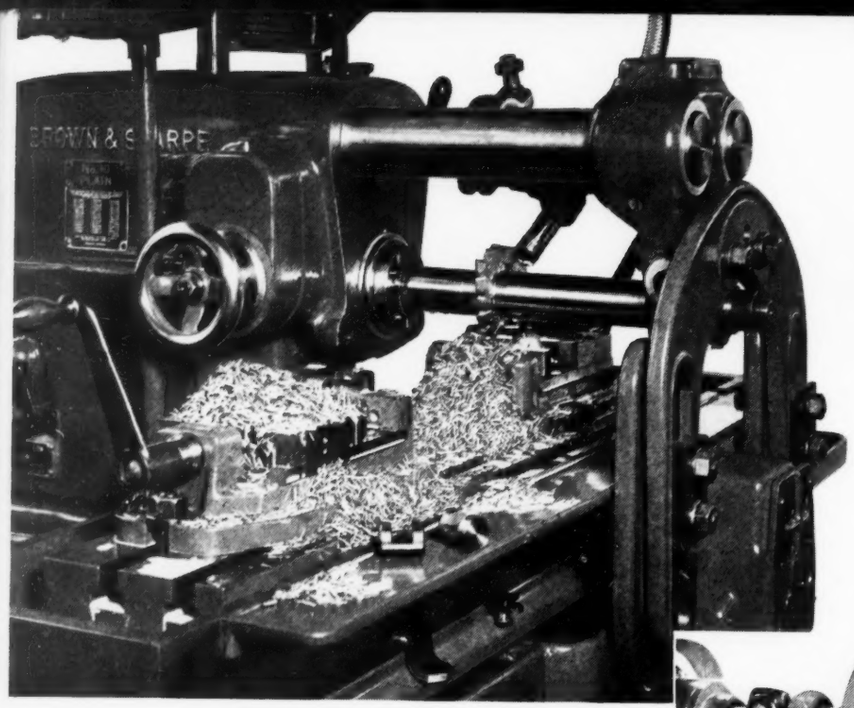
## New York and New Jersey

BRITISH PURCHASING COMMISSION, 25 Broadway, New York City, of which ARTHUR B. PURVIS is director-general, announces the following appointments to the Commission: Director of Purchases, EDGAR S. BLOOM; Director of Administration, F. JOHNSON. Mr. Bloom retired from the presidency of the Western Electric Co. during the latter part of December, under the company's rule that provides for retirement at the age of sixty-five, thereby concluding a career of forty-three years with the Bell Telephone System. Mr. Johnson has been vice-president of the Bell Telephone Co. of Canada since 1935.

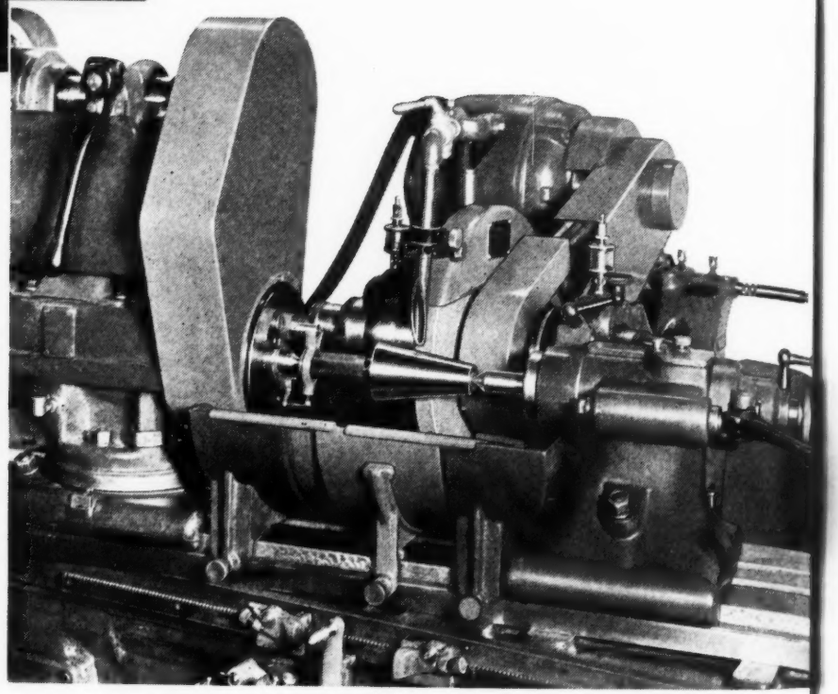
ROBERT E. DILLON, president of the Lake Erie Engineering Corporation, Buffalo, N. Y., has been elected a director of the Marine Trust Co. of Buffalo. Mr. Dillon's career in the manufacturing business began in 1925. Aside from directing the activities of the Lake Erie Engineering Corporation, which manufactures a wide variety of hydraulic presses, he has many other business and civic activities. He is a member of the Committee on Public Relations of the National Association of Manufacturers, and a director of a number of business and financial concerns.

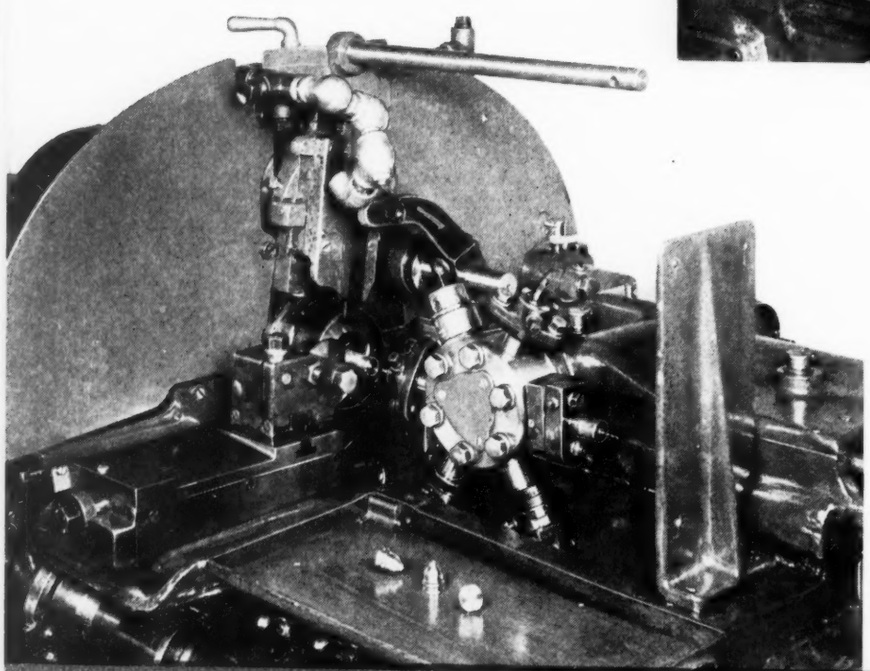
DOUGLAS F. G. ELIOT, general commercial manager of the Western Electric Co., 195 Broadway, New York City, for the last three years, has been appointed general purchasing agent of the company. In this capacity, he will take charge of the company's purchasing department which spends approximately $75,000,000 a year for the Bell System. Mr. Eliot is a graduate of Yale University, class of 1909. He has been connected with the Western Electric Co. since 1911.

CLARENCE G. STOLL has been elected president of the Western Electric Co., 195 Broadway, New York City, succeeding EDGAR S. BLOOM, who has retired. Mr. Stoll has been vice-president in charge of operations since 1928. He has



# Invest





B·S

# BROWN &

# *in* MODERN MACHINES

## for Profitable Production

### Milling Machines

Universal — Omniversal — Plain — Vertical

### Grinding Machines

Universal — Plain — Surface — Tool

### Screw Machines

Automatic — Wire Feed

**• • • Brown & Sharpe Machine Tools have the accuracy and productive capacity needed for profitable manufacturing.**

**Send for your copy of No. 141 Catalog showing the complete line. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.**



SHARPE

spent his entire business career of thirty-six years with the Western Electric Co., entering the company's employ immediately upon graduating from Penn State College in 1903.

DALRAE TOOLS CO., 501 E. Water St., Syracuse, N. Y., has just completed the third addition to the company's plant in two years. The latest addition consists of a one-story building of 20,000 square feet, located at 1868 Erie Blvd. In this plant, the Dalrae milling attachments will be manufactured. Every machine tool in the addition is new. Showrooms will also be maintained for the MacRae Machinery Co.

R. L. JOHNSTONE has been appointed manager of the Shaker Division of the Ajax Flexible Coupling Co., Westfield, N. Y. Mr. Johnstone has had long experience in the design, manufacture, and sale of screening, conveying, and feeding equipment.

WILLIAM and WALTER SCHMITT, 80 Twenty-second St., Irvington, N. J., have been appointed sales representatives for the Rawlplug Co., Inc., 98 Lafayette St., New York City, to cover the northern New Jersey territory formerly handled by the late P. L. Pinney. The Rawlplug Co. manufactures a complete line of anchoring devices and masonry drills.

MAYNARD D. CHURCH has been elected vice-president of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Church is also president of the Moore Steam Turbine Corporation, Wellsville, N. Y., a Worthington subsidiary. He will continue to be in charge of operations at the Moore plant.

CURTISS PROPELLER DIVISION OF THE CURTISS-WRIGHT CORPORATION, Clifton, N. J., is erecting its second addition within one year. The present building is a one-story structure which adds approximately 11,000 square feet to the plant area, bringing the total area up to 110,000 square feet.

## Pennsylvania

Dr. V. N. KRIVOBAK, associate director of research, Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., delivered the first of a series of lectures before the Houston, Tex., chapter of the American Society for Metals December 8, on the subject "Recent Developments in Heat- and Corrosion-Resisting Steels." Following this, he delivered a number of other lectures in San Francisco and Los Angeles, Calif.; Portland, Ore.; and Seattle, Wash.

STANDARD PRESSED STEEL CO., Jenkintown, Pa., maker of Hallowell shop equipment and Unbrako socket screw products, is erecting a 12,000 square foot addition to its main plant in order to provide more adequate facilities for steel storage and other purposes. The new structure is of steel, brick, and glass construction.

MCKENNA METALS CO., Latrobe, Pa., has granted the GEORGE H. ALEXANDER MACHINERY, LTD., Birmingham, England, an option on the McKenna patents to manufacture Kennametal in Great Britain.

WYCKOFF DRAWN STEEL CO., Pittsburgh, Pa., has appointed C. GRINDROT sales engineer, with headquarters at 3201 S. Kedzie Ave., Chicago, Ill.

## Texas and Alabama

WHEELCO INSTRUMENTS CO., 1929-1933 S. Halsted St., Chicago, Ill., manufacturer of indicating and control instruments, has appointed the RODGERS ENGINEERING CO., 204 Thomas Bldg., Dallas, Tex., representative for the north Texas territory.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has appointed C. H. Vaughan, 1112 S. 26th St., Birmingham, Ala., representative in the southeastern states.

# COMING EVENTS

JANUARY 15-19—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

JANUARY 22-26—Winter convention of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS in New York City.

FEBRUARY 2-3—Fourth biennial WELDING CONFERENCE on Electric and Oxy-Acetylene Welding at the Texas Technological College, Lubbock, Tex. For further information, address J. C. Hardgrave, Mechanical Engineering Department of the college.

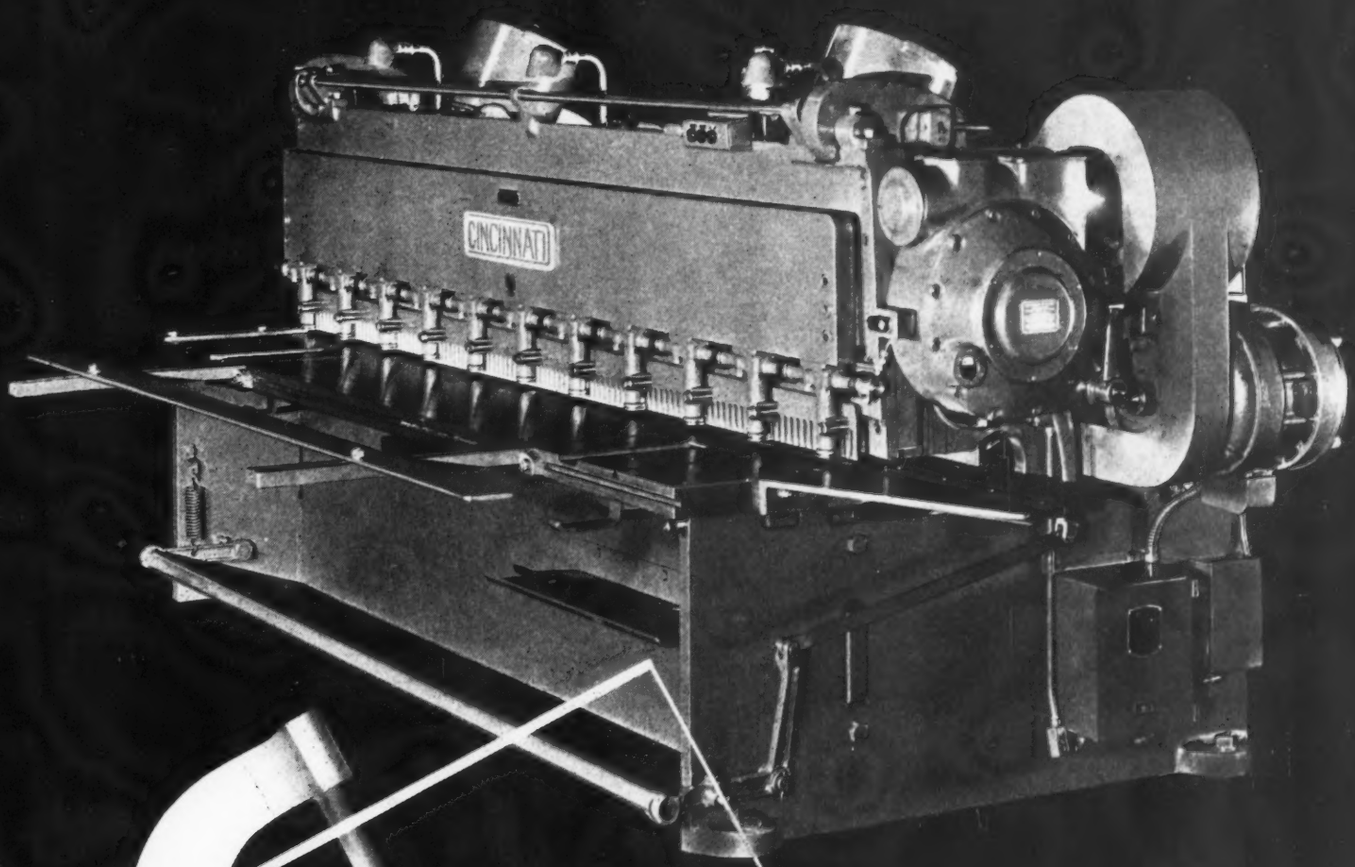
MARCH 7-9—Annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in New York City. For further information, communicate with Ford R. Lamb, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

MAY 6-10—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in Chicago, Ill., with exhibits at the International Amphitheater, and headquarters of the convention at the Palmer House. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

JUNE 9-14—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 7-11—NATIONAL SAFETY CONGRESS AND EXPOSITION to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

Unusual Lightness Combined with Strength is a Feature of the Improved Spray Gun Here Shown, which is a Product of the Willard C. Beach Air Brush Co., Harrison, N. J. This Spray Gun is Made of Dowmetal and Weighs Only 10 Ounces, whereas its Aluminum-forged Predecessor Weighed Approximately 13 1/2 Ounces. A Similar Gun Made from Bronze Thirteen Years Ago Weighed 31 1/2 Ounces




# MICROMETER ACCURACY

Shearing to close limits . . . Cincinnati All-Steel Shears . . . perform with machine tool-like accuracy. Write for complete descriptive Catalog (Form 5).

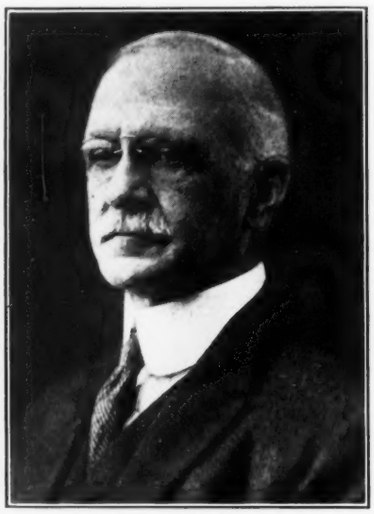
THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS · SHEARS · BRAKES

# OBITUARIES

## Fred J. Miller

Fred J. Miller, formerly general manager of the five factories of the Remington Typewriter Co., for many years editor-in-chief of the *American Machinist*, and a past-president of the American



*Fred J. Miller*

Society of Mechanical Engineers, died November 26 at his home in Center Bridge, Pa., at the age of eighty-two years.

Mr. Miller was born in Yellow Springs, Ohio, in 1857. After learning the machinist trade, he worked as a toolmaker, and at that time began to write articles for the *American Machinist*. In 1887, he came to New York as associate editor of that publication, soon being made editor-in-chief. He was recognized as one of the leading men in technical journalism of that day.

In 1907, Mr. Miller gave up his editorial work to become general manager of the plants of the Remington Typewriter Co. He remained in that position until 1918, when he was appointed major in the Ordnance Department and assigned first to the Rock Island Arsenal and later to the Bethlehem Steel Co. In 1924-1925, he served on the Pennsylvania Public Service Commission under Governor Pinchot.

Mr. Miller was an authority not only on machine shop engineering, but also on industrial management. He acted as a consultant in industrial engineering, and by joint action of the American Society of Mechanical Engineers and the Institute of Management, he was awarded the Gantt medal in 1929. He was a member of the Hoover Committee to study waste in industry. In past years, he was exceptionally active in the affairs of the American Society of Mechanical Engineers, which he joined in 1890, serving as president of the Society in 1920. He was also a member of the American Association for the Advancement of Science. Mr. Miller was a man who commanded the respect and admiration of all who came in contact with him during his long active life.

## Fritz J. Frank

Fritz John Frank, president of the Iron Age Publishing Co., died on December 8 at the Northern Westchester Hospital, Mount Kisco, N. Y., after a brief illness, at the age of sixty-eight years.

Mr. Frank was born in Emporium, Pa. He graduated from Rollins College, in Florida, with the degree of Bachelor of Arts in 1896. Shortly afterward he began his publishing career by joining the *Colliery Engineer*, which later became *Mines and Minerals*, as advertising manager. In 1906, he joined the *Mining and Scientific Press* as Chicago representative, and in 1910, he went with *The Iron Age* as advertising manager in the New York territory. He contributed largely to the upbuilding of that publication. In 1911, Mr. Frank was made secretary of the David Williams Publishing Co., the predecessor of the Iron Age Publishing Co., and in 1918, he was elected vice-president. In 1919, he became president, which position he occupied until his death.

In addition to his executive positions with *The Iron Age*, Mr. Frank was also executive vice-president of the Chilton Co., and a director in the Robbins Publishing Co., the Business Publishers International Corporation, the Newton Falls Paper Co., and the Savage Arms Co. He was a trustee of Rollins College, and in 1935, he received the Decoration of Honor from that institution for "a distinguished career in business and outstanding service to his alma mater." Mr. Frank is survived by his wife, Anna Raynor (Bush) Frank, whom he married in 1909, and by a brother and a sister.

*Fritz J. Frank*

## Clarence W. Spicer

Clarence W. Spicer, vice-president of the Spicer Mfg. Co., Toledo, Ohio, died in Miami, Fla., November 21, at the age of sixty-three years. Mr. Spicer attended Cornell University. In 1902, he founded the Automotive Parts Corporation, soon after he had invented and developed the Spicer universal joint. In 1910, he organized the Spicer Mfg. Co., Plainfield, N. J., of which he was the head until 1914. In 1915, he became vice-president of the Spicer Mfg. Corporation, manufacturer of universal joints, which was moved to Toledo in 1930.

Mr. Spicer was a past-president of the Society of Automotive Engineers, and he had also served as chairman of the Committee on Standardization of Small Tools and Machine Tool Elements of the American Society of Mechanical Engineers.

WILLIAM DICKSON PIERSON, secretary and director of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., died at his home in that city on December 2, at the age of sixty-seven years. Mr. Pierson was born in Orange, N. J. He graduated from the Stevens Institute of Technology in 1894 and joined the engineering staff of the Waterbury Farrel Foundry & Machine Co. in 1895. At his death, he had completed nearly forty-five years of continuous service with the company.

Mr. Pierson was well known and highly regarded, especially in the wire-drawing machine field, as an engineer and machine designer of unusual capabilities. He was a director of the National Wire Machine Builders Association.

FRANK LUDLAM, assistant secretary and assistant treasurer of the International Nickel Co., Inc., New York City, died on December 8 at his home at 1130 Park Ave., New York City, after a long illness. Mr. Ludlam was born in Bloomfield, N. J., in 1873. He studied architecture at the Columbia School of Mines, and after spending several years in the achitectural and real estate fields, he became connected with the Carnegie Steel Co., Pittsburgh, Pa. In 1903, he joined the International Nickel Co.

ALBERT E. HARRIS, for many years a salesman for the Brown & Sharpe Mfg. Co., died on November 30 in Providence, R. I., after a short illness. For over

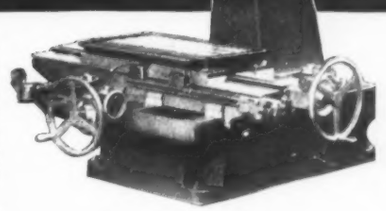
# TO FIND THE SECRET OF *Profitable Production* . .

look to the Cincinnati Bickford Super Service Line of Radials and Upright Drills! There you'll find exactly the right size machine for your individual needs—the Drill which will unquestionably speed up production — improve the quality of your work —increase your profits.

**CINCINNATI BICKFORD SERVICE**

The engineering staff offers to make a preliminary survey of your plant to determine its precise requirements, so as to avoid errors which might prove costly. This Service—offered without the least obligation—recommends equipment to exactly fit your own individual requirements. Write.

Every Cincinnati Bickford Super Service Machine features convenient centralized controls, a vital convenience which eliminates expensive waste of time and effort. The wide choices of feeds and speeds—the range and versatility of each machine —the numerous safety measures—the powerful clutch mechanisms—the sturdiness, accuracy and rigidity engineered for each individual design—these are but a few important features which make for consistently better production and increased profits with Cincinnati Bickford Machines.



CATALOG ON REQUEST

## THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

forty years. Mr. Harris had been employed in the manufacturing and sales departments of Brown & Sharpe. He was well known among machine tool users in northern New England.

WILLIAM Y. BANKS, manager of the steel castings sales division at the Brackenridge plant of the Allegheny Ludlum Steel Corporation, died November 23 at his home in Aspinwall, Pa., at the age of fifty-four years. Mr. Banks joined the Allegheny Steel Co., now the Allegheny Ludlum Steel Corporation, in 1924, as a salesman.

JOHN L. OSGOOD, president, treasurer, and general manager of the J. L. Osgood Machinery & Tool Co., Inc., Buffalo, N. Y., died on November 21.

# NEW BOOKS AND PUBLICATIONS

GAS ENGINE HANDBOOK. By the Gas Engine Power Committee, D. W. Reeves, chairman. 58 pages, 8 1/2 by 11 inches. Published by the Industrial Gas Section of the American Gas Association, 420 Lexington Ave., New York City. Price, $1.

This handbook on gas engines contains data and information collected over a period of years by C. Remschel, of the Southern Counties Gas Co. of California. Mr. Remschel is the author of most of the contents of the book. Beginning with the early history of gas engines, the book covers the operating cycle of the gas engine; gas engine applications; horsepower formulas; gas engine auxiliaries, including gas mixers, ignition systems, starting systems, and lubrication; power take-off, including clutches, pulleys, belts, idlers, speed reducers, and speed increasers; protective devices; exhaust systems; cooling systems; piping; foundations; calculations of the cost of operation; estimating gas consumption; gas engine fuel economy; natural gas engine advantages; gas-Diesel combination engines; and stand-by service.

PRODUCTION MANAGEMENT. By A. M. Simons. 588 pages, 5 3/4 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $3.50.

This is a revised edition of a book dealing with various phases of industrial management. Among the subjects discussed are: Use of Science in Industry; Location of an Industry; Planning a Plant; Fixing Standards; Purchasing; Scheduling for Production; Office Organization and Management; Drafting, Tool-Room and Inspection; Shipping and Packing; Wages; Human Nature and Management; Training New Workers; Promotion and Personal Records; Working Conditions and Fatigue; and Building Leadership.

A HISTORY OF THE GROWTH OF THE STEAM ENGINE. By Robert H. Thurston. 545 pages, 5 by 8 inches. Published by the Cornell University Press, 124 Roberts Place, Ithaca, N. Y. Price, $3.

This is the centennial edition of a well-known work on the steam engine, first published in 1878. The value of this book is attested by the fact that there is still a sufficient demand for it to warrant a new edition. The original material covered the period ending with the last century, but a supplementary chapter has been added tracing some of the more important developments in steam-power engineering since that time.

DIRECTORY OF MATERIALS (1939-1940). Published by *Machine Design*, Penton Bldg., 1213 W. Third St., Cleveland, Ohio. Price, 25 cents.

This is the seventh edition of a directory covering all the metallic and nonmetallic materials used in the design and manufacture of machinery. The new directory contains 371 tradenamed metallic materials and 136 tradenamed nonmetallic materials; 173 different manufacturers of metallic materials are listed and 75 manufacturers of non-metallic materials. A keyed explanation of the characteristics of the different materials is included.

HOW TO BUY, SELL, AND BURN COAL. By Thomas A. Marsh. 97 pages, 4 5/8 by 6 1/2 inches. Published by the author, 5625 Kenwood Ave., Chicago, Ill. Price, $1.

This little book gives information on how to select coal for manufacturing plants, for commercial heating plants, and for residential use. The author gives points on how to reduce fuel bills, stop smoke, increase efficiency, increase steam output, size stoker coal, "read fires," and "shoot trouble" on coal and stokers.

HUMAN-RELATIONS MANUAL FOR EXECUTIVES. By Carl Heyel. 253 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $2.

This book presents various ideas for selecting, developing, stimulating, safeguarding, and guiding the working force, taken from the actual experience of different companies. The ideas have been chosen according to their suitability for use by other companies and industries.

TENSILE ELASTIC PROPERTIES OF 18-8 CHROMIUM-NICKEL STEEL AS AFFECTED BY PLASTIC DEFORMATION. By D. J. McAdam, Jr., and R. W. Mebs. 42 pages, 9 by 11¼ inches. Published by the National Bureau of Standards, Washington, D. C., as Report No. 670 of the National Advisory Committee for Aeronautics. Price, 15 cents.

RATE OF OXIDATION OF STEELS AS DETERMINED FROM INTERFERENCE COLORS OF OXIDE FILMS. By Dunlap J. McAdam, Jr., and Glen W. Geil. 62 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper RP1221 of the National Bureau of Standards. Price, 10 cents.

THE EFFECT OF RANGE OF STRESS ON THE TORSIONAL FATIGUE STRENGTH OF STEEL. By James O. Smith. 38 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 5 of Bulletin Series No. 316 of the Engineering Experiment Station. Price, 45 cents.

FATIGUE TESTS OF CONNECTION ANGLES. By Wilbur M. Wilson and John V. Coombe. 24 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 6 of Bulletin Series No. 317 of the Engineering Experiment Station. Price, 30 cents.

STRESS, STRAIN, AND STRUCTURAL DAMAGE. By Herbert F. Moore. 24 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 10 of Reprint Series No. 15 of the Engineering Experiment Station. Price, 15 cents.

THE EMPLOYES VIEWPOINT TOWARD PERSONNEL INDUSTRIAL RELATIONS AND TRAINING. 109 pages, 6 by 9 inches. Published as Extension Series No. 45, by the Engineering Extension Division of Purdue University, Lafayette, Ind.

MEASUREMENT AND ANALYSIS OF NOISE AND VIBRATION. By Daniel Silverman. 32 pages, 8 3/4 by 11 3/4 inches. Published by the Instruments Publishing Co., 1117 Wolfendale St., Pittsburgh, Pa. Price, 50 cents.

INDUSTRIAL HAZARDS OF STATIC ELECTRICITY. By Harold Joe Davis. 9 pages, 4 by 6 1/4 inches. Distributed by the author, 3927 E. Admiral Place, Tulsa, Okla. Price, 25 cents.